Railway Mechanical Engineer

Volume 100 NOVEMBER, 1926 No. 11

Table of Contents

EDITORIALS:

The reading of books 649
Fall meeting of Welding Society 649
The annual meeting of the A.S.M.E. 649
A thought for machine tool builders 650
Is annealing a restorative for metal fatigue? 650
Can you afford to make tools? 651
Standardizing drafting room practice 651

GENERAL:

Three-cylinder locomotives for D. & R. G. W. 652
Henry Ford and his philosophy 657
The locomotive of tomorrow 658
High tractive effort no longer the only consideration 658
Some details that must not be overlooked 659
A big field for future development 661
Trends in locomotive development 662
Apprentices and self-government 665
St. Paul places order for roller bearing equipment 667
Filing of drawings and drafting room correspondence 670

CAR DEPARTMENT:

Fabricating steel car parts 673
Decisions of the Arbitration Committee 675
Chief Interchange Inspectors' proceedings 677
A. R. A. record and billing repair cards 677
Progressive repairs to house cars 679
Question box report 681
Equipment for renovating car journal packing 682
Modern lacquer for railroad use 683
Speeding up the testing of triple valves 685
No lead poisoning at Pullman works 685
Air hose clamping machine 686

SHOP PRACTICE:

Brass and air brake departments of B. & M. Billerica shops 687
Avoiding delay when a valve gear breaks 691
Bronze-welding copper 692
Special tools for machining tank valve bodies 692
Lehigh Valley has well organized system shops 693
Stripping paint from locomotive tenders 699
Loading cinders from locomotive ash pits 700

THE READER'S PAGE:

A question of three-cylinder valve motion patents 701
Tests of cast iron brake shoes—An opinion 701
Car wheel grinding advocated 702
Another method of making spring bands 702

NEW DEVICES:

Chambersburg Type B steam drop hammer 703
Hot forged steel unions 704
B. & S. surface grinding machine 704
Portable motor-driven universal saw 705
Superior 10-in. bench drill 706
Four-foot radial drilling machine 706
Rotary opening die head for shoulder threading 707
Double diaphragm lubricator check valve 707
P. & B. self-protecting oil burner 708
Model B 12-in. vertical shaper 708
Drum controllers for machine tools 710
Electric welder for flues and tubes 710
New sizes of Lo-Hed electric hoists 711
Sixteen-inch geared-head lathe 711
Automatic band saw sharpener 712
Automatic drifting throttle and relief valve 713
Band saw filer and setter 713
Individual sanitary washbowls 714
Metal melting pot with a large capacity 714

NEWS OF THE MONTH 715

The Pennsylvania's new Mountain type locomotives will be described in the December issue

PUBLISHED ON THE FIRST THURSDAY OF EVERY MONTH BY THE SIMMONS-BOARDMAN PUBLISHING COMPANY

EDWARD A. SIMMONS, *President* HENRY LEE, *Vice-Pres. & Treas.*
L. B. SHERMAN, *Vice-President* SAMUEL O. DUNN, *Vice-President*
CECIL R. MILLS, *Vice-President* ROY V. WRIGHT, *Secretary*
30 Church Street, New York, N. Y.
F. H. THOMPSON, *Vice-President and Business Manager, Cleveland*

Chicago: 608 South Dearborn St. Cleveland: 6007 Euclid Ave.
Washington: 17th and H Sts., N. W. New Orleans: Mandeville, La.
San Francisco: 74 New Montgomery St.
London: 34 Victoria Street, Westminster, S. W. 1.
Cable Address: Urasigmec, London

ROY V. WRIGHT, *Editor*
C. B. PECK, *Managing Editor*
E. L. WOODWARD, *Associate Editor* L. R. GURLEY, *Associate Editor*
MARION B. RICHARDSON, *Associate Editor* H. C. WILCOX, *Associate Editor*

Entered at the Post Office at New York, N. Y., as mail matter of the second class.

Request for change of address should reach the New York office two weeks before the date of the issue with which it is to go into effect. It is difficult and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address, be sure to send us your old address as well as the new one.

Subscriptions, including the eight daily editions of the Railway Age published in June, in connection with the annual convention of the American Railway Association, Mechanical Division, payable in advance and postage free: United States, Canada and Mexico, $3.00 a year; foreign countries, not including daily editions of the Railway Age, $4.00. When paid through the London office, 34 Victoria Street, S. W. 1, 17s. 0d. Single copy 35 cents, or 1s. 6d.

The *Railway Mechanical Engineer* is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.).

Speeding Up Boiler Repairs

Ryerson Flue-Cleaning Machine
Overhead Framework Type

This machine raises and lowers the tubes into the pit by its own power, thus eliminating handling expense. One man can load and start the machine in eight minutes and unload it in the same time. Its capacity of 350-2" flues up to 24' long permits cleaning a whole set of flues from the largest locomotive without separating them.

RYERSON Flue Shop Equipment has greatly reduced the time usually necessary for boiler maintenance on a number of the leading trunk line roads. In the shops where general locomotive repairs are handled, this equipment has reducd costs to between two and three cents per tube. The smaller shops make a proportionate saving.

In the Flue Shop as in almost all other departments of locomotive repair, costs are quickly reduced by modern machinery and the arranging of the sequence of operations so that the maximum output is maintained. Our engineers, experienced in these special departments are at your service for assistance in modernizing your shop.

Complete Flue Shop equipment is shown in our bulletin 19401. Write for a copy.

JOSEPH T. RYERSON & SON INC.

Established 1842

PLANTS: CHICAGO MILWAUKEE ST. LOUIS CINCINNATI DETROIT BUFFALO BOSTON NEW YORK
Branch Offices: Pittsburgh Cleveland Minneapolis Louisville Denver Tulsa Houston Los Angeles San Francisco

RYERSON MACHINERY

Lathes	Punches	Small Tools	Horizontal Drills	Serpentine Shears
Drills	Shears	Friction Saws	Power Hammers	Hydraulic Machinery
Planers	Motors	Bevel Shears	Bending Rolls	Spring Shop Equipment
Shapers	Bulldozers	Milling Machines	Pneumatic Machinery	Flue Shop Equipment

Railway Mechanical Engineer

Vol. 100 November, 1926 No. 11

The reading of books

Astonishing advances have been made all along the line on the railways in this country during the years which have elapsed since the close of the world war and particularly since the return of the railroads to their owners after the period of federal control. This advance is particularly noteworthy in the mechanical department in the improvements in the design of cars and locomotives, the better maintenance and utilization of the equipment and the finer spirit of teamwork and co-operation between the men and the managements. The whole standard of management and operation has been raised to a new and much higher level; moreover, the standard of intelligence and education of the boys and young men who are entering the service has been steadily improving. It is therefore more necessary than ever that the foremen and officers should make special efforts to better fit themselves for the positions of responsibility and leadership which they occupy. It is important that they give a certain amount of time to the reading and study of the technical papers and books which can be of the greatest practical value and inspiration to them. One progressive shop superintendent, recognizing this need, has taken a number of technical books from his own personal library and placed them in a bookcase in the general foreman's office as a nucleus for a circulating technical library for the use of the foremen and workers in the plant. The outcome of the experiment will be awaited with much interest. Will the men make good use of this facility unless some enthusiast gets behind it and encourages the men to make use of it? Will the men become sufficiently interested to co-operate in enlarging the collection to make it comprehensive and also of more particular value to some of the special groups in the organization? Has anyone made a similar experiment? To what extent has it succeeded?

Fall meeting of Welding Society

All railroad men interested in welding should make a special effort to attend the fall meeting of the American Welding Society to be held in Buffalo, N. Y., November 16, 17, 18 and 19, in connection with which there will be an extensive exhibition and demonstration of welding apparatus, supplies and methods. The technical sessions are being arranged to include papers and discussions pertaining specifically to welding problems of the railroads. Fusion welding received its first impetus on the railroads, which were quick to appreciate its possibilities as a process for quickly and economically repairing certain locomotive parts. As a result of this impetus, many railroad welding men turned to welding as a "cure all," with the result that regulatory bodies have made certain restrictions on welding in the interest of safety. These restrictions, naturally, have slowed up the advancement of the art on the railroads and most of the other metal industries have now far surpassed the railroads in the applications of fusion welding. However, the railroads have now reached a sound basis on which to proceed with the adaptation of welding in the maintenance of locomotives and cars. The period of hesitancy in development work is past. The railroad welding expert has been working out new and safe welding processes, has been improving welding methods, has been experimenting with the latest developments in welding equipment and is now ready to go ahead and take his place in developing the art of welding along with the other industries. Those interested in railroad welding will have a splendid opportunity at the fall meeting of the American Welding Society not only for a profitable exchange of ideas but to learn of the latest developments in equipments and their application.

The annual meeting of the A.S.M.E.

A coming event of importance to mechanical department officers is the annual meeting of the Americal Society of Mechanical Engineers which is to be held in the Engineering Societies Building, New York, December 6 to 9, inclusive. An additional attraction is also provided during the same week in the fifth national exposition of power and mechanical engineering, which is being held at the Grand Central Palace. The tentative program for the A. S. M. E. meeting, which is published on another page of this issue, contains a considerable number of subjects that should be of interest to mechanical engineers having to do with railway equipment The two papers being presented by the Railroad Division are not only of a timely nature but the division is fortunate in having them presented by men whose positions eminently fit them to handle their subjects. Professors E. C. Schmidt and J. M. Snodgrass, both on the faculty of the University of Illinois, are scheduled to present a paper on "The use of high steam pressure in locomotives" and L. K. Sillcox, general superintendent of motive power, Chicago, Milwaukee & St. Paul, is to present a paper on the "Balancing factors in use and obligations covering ownership of freight train cars." Some of the papers being presented by the other professional divisions of the society are of value to railway officers and should have many practical applications to mechanical department work.

Compared with the many other railway organizations, the American Society of Mechanical Engineers, through its Railroad Division, occupies a unique position inasmuch as it is essentially a professional, rather than an official organization. It provides a common meeting

ground for mechanical engineers in both the railway and railway supply industries where they can discuss railway mechanical engineering problems with which they are mutually concerned. Included in its membership are mechanical engineers engaged in railroad work, in the railroad supply industry, in consulting practice, and as teachers in the technical schools. Many of these men represent the finest mechanical engineering talent in the country. This meeting offers an opportunity not provided by any other convention in the railroad field. Attendance will be well worth the while of every mechanical department officer who believes in the need for intensive future development of railway motive power and rolling stock.

A thought for machine tool builders

It is entirely proper that the efforts of equipment designers and builders should be devoted to the field where the greatest activity in development work is evident. Over a period of the last 10 or 15 years the development of automotive equipment has taken place with such rapid strides that machine tools suitable for the production of such equipment have in many cases become obsolete almost over-night. In contrast, changes which have taken place in railroad shops, while of great importance, have been less spectacular. Anyone familiar with the progress which has been made in such shops realizes that while many shops are now equipped with modern machinery, the great majority of them leave much to be desired in their machine tool equipment when the type of modern motive power now being repaired is taken into consideration.

The railroads have been criticized for being slow to adopt new methods and modern machinery, yet it has been pointed out that this apparent lack of appreciation of modern equipment has not been due entirely to lack of progress on the part of mechanical officers but to a great extent to the fact that limited appropriations often make necessary a severe curtailment of new machine tool installations. Relatively, there is no doubt that the automotive field has offered a more extensive and profitable market to the machine tool builder, but under present conditions, is it not reasonable to suppose that the railroads may offer an increasingly profitable market in comparison to the automotive shops? The rapid development of automotive equipment and the expansion of plants has made it necessary for the machine tool builder constantly to bring out new machines in order to supply the demands of present day production. Is it not possible that the less rapid progress on the part of railroads in rehabilitating their plants has been due to the fact that relatively little effort has been made on the part of machine tool builders to develop machines particularly suited to the class of work which a railroad shop must perform? In all too many cases the effort has been made to sell to the railroads machine tools designed primarily for production work—a type which has a very limited field in the railroad shop.

The modern locomotive with its increasing number of accessories demands much finer machine tool equipment for its maintenance than did its predecessor of some 15 or 20 years ago. It seems well worth while for the machine tool builder to study the particular needs of the railroad shop today with a view to designing special machines particularly capable of handling the class of work which the maintenance of modern motive power demands. It seems reasonable to suppose that with the continued betterment of the railway financial condition the market for machine tools on the railroads should present an opportunity for the builder who is willing to devote his efforts towards supplying the class of machine tool equipment and service that the modern railroad repair shop demands.

Is annealing a restorative for metal fatigue?

When no other readily obvious reason can be found to explain the failure by fracture of axles, crank pins, rods and other steel parts, it is still quite commonly the practice to fall back on the all-inclusive term "crystallization" as a sufficient explanation of the cause of the fracture. The idea back of the long-continued belief in this theory of complete structural change of the material as the result of the repeated variations and reversals of stress, no doubt arose originally from the coarse crystalline structure apparent at the surface of the break which is characteristic of most failures where the section has been gradually reduced by a progressive fracture until the much-overloaded remainder of the section suddenly lets go. This coarse crystalline appearance is in sharp contrast to the fracture of a test specimen of uniform section in a tensile testing machine.

As a corollary of this theory of the process of metal fatigue, it has long been the common practice of many railroads to anneal at more or less regular intervals those parts subject to repeated stress in service, the idea being that the annealing process restores the structure of the metal to its original condition so that it again enters service with an entirely new lease of life.

Recent scientific investigations of the fatigue of metals —notably those which have been under way for some five years past at the Engineering Experiment Station at the University of Illinois,—have brought to light information concerning the changes in metal which ultimately lead to fatigue failure which make it very questionable whether the annealing process is of any value whatever as a means of increasing its life. Examination of the changes in structure under the microscope indicates that when the metal is subject to repeated stresses which reach beyond a certain proportion of its ultimate strength—this proportion depending upon the composition of the metal and its heat treatment—so-called "slip-lines" make their appearance. These "slip-lines" apparently represent changes in the alinement of the material in the crystals themselves which, if not microscopic fractures, at least result in the beginning of fractures within the metal of the section which did not show up at the surface. They do not represent a change in the crystalline structure of the material, but a weakening or failure of the permanently fixed crystals themselves.

Crystallization, therefore, ceases to be an explanation of failure. The coarsely crystalline appearance of the fracture is apparently caused by the comparatively inelastic action at the point of failure because of the sharp reduction in section at this point, rather than from any progressive change in the structure of the metal during the course of its service. It is probably too early to conclude definitely that these "slip-lines" are actually microscopic cracks, but if they are, it is evident that no amount of annealing can restore the original strength of the material. In any event, the fact that they seem to be the first step in the formation of such cracks, which are likely to develop long before the evidence of ultimate failure can be detected at the surface of the metal, is sufficent to indicate that annealing, to say the least, is a useless practice and to suggest very strongly that those whose confidence in the safety of such parts is based on their adherence to the practice of annealing are living in

a fool's paradise. As far as the investigations of this subject have gone, they indicate that safety lies only in keeping the value of the repeated or alternating stresses within a certain proportion of the ultimate strength of the material, below which fatigue changes in the structure do not take place.

Can you afford to make tools?

A trip through almost any railroad shop, particularly the older ones, will reveal the presence of many home-made pieces of shop equipment and tools. Most of these devices serve well their intended purpose, many of them are ingenious and all indicate the initiative of the men in the shop. A railroad repair shop justifies its existence only as a means of maintaining the equipment used in the production of transportation, and in so functioning it falls short of its potential efficiency if certain of its production forces are directed in other channels toward the performance of a task which could more efficiently and economically be performed by some agency better organized for that particular work.

In many cases the apparent necessity for utilizing the labor of a certain portion of a shop's forces in the construction of equipment for use in that shop seems to be the difficulty in securing the approval to purchase equipment especially designed to perform the work for which the home-made equipment is constructed. It is true that the purchase of new shop equipment represents a capital expenditure, whereas in building the equipment with shop forces the actual labor and material charge incurred may, for example, be borne by the maintenance of shop machinery and tools account and finally appear as an operating expense rather than a charge to investment.

The tendency today is toward the reduction of operating expense and the greater utilization of equipment. While the more spectacular strides in this respect have been made through the introduction of modern motive power together with its more intensive utilization, is it not possible that opportunities have been overlooked for effecting substantial economies in the introduction of properly designed modern shop equipment which, by virtue of its having been designed for modern service, will permit greater utilization?

In most instances could not the labor and creative ability devoted to the construction of shop-made equipment be better directed to the improvement of methods for repairing locomotive and cars? And, aside from the possible saving in construction costs, there is also the potential saving in operating costs of devices of this nature, particularly that great number of devices operated by compressed air—one of the most expensive sources of power in the shop.

Improvement in shop methods is certain to result in a demand for improved shop equipment, and where the development of better methods has proceeded along systematic lines, it should not be difficult to determine the economies which the introduction of new equipment would make possible. Modern motive power demands modern shop equipment and machine tools for its successful maintenance. The greater utilization of properly designed shop equipment will reduce the out-of-service time necessary for the maintenance of motive power and rolling stock. An intelligent analysis of present methods should reveal opportunities for effecting operating economies great enough to offset any desirable expenditure for new equipment.

Specialized manufacturing organizations have made possible the remarkable development of the modern locomotive. Other specialized manufacturers stand ready to assist in the reduction of maintenance equipment costs. Can you afford to direct the efforts of a certain portion of your shop organization, the real job of which is repair work, to the manufacturer of equipment that might better be furnished by a manufacturer whose organization is devoted solely to the production of that specialized equipment?

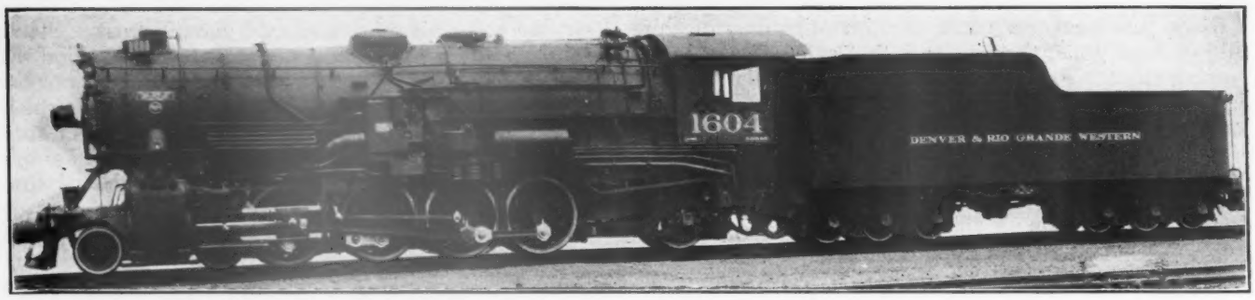
Know what you need, why you need it, determine beyond any doubt what savings will be effected by its introduction, and if the man higher up really wants to save money, your request for purchase will be approved.

Standardizing drafting room practice

A sectional committee is being organized by the American Society of Mechanical Engineers and the Society for the Promotion of Engineering Education, under the direction of the American Engineering Standards Committee, to formulate national standards for drafting room practice. The scope of this committee's project includes such important items as the classification of a corresponding nomenclature for drawings in accordance with their purpose: method of representation of the subject, including the arrangement of views and sections; arrangement of borderline, title, part list, notes, changes and revisions: method of folding and punching prints; kinds and sizes of drawings and filing cabinets; width of rolls of paper and cloth; size of drafting equipment and tools; and specifications for materials to be used for drawing.

Practically all mechanical department drafting rooms with a blue print output of any reasonable proportion have formulated standards to meet their own requirements. Likewise practically all of the railway supply firms have adopted standards for their drawings that have been worked out to suit not only their own shop requirements, but certain demands of the trade and competition as well. This independent policy on the part of the various companies has resulted in considerable waste in both drafting room labor and material. In all probability the railroads are the greatest sufferers, but many railway equipment builders are put to considerable extra expense when they are required to furnish drawings for equipment according to a purchasing railroad's standards. For example, some companies use first angle projection; others use third angle projection. Many railway equipment builders have the title, part lists, revisions, etc., in the upper right hand corner, while it is noted that many railroads locate such information in the lower right hand corner. Of course, the system of filing blue prints has considerable to do with the location of the title, drawing number, etc., and is an item of drafting room practice which is included in the committee's project.

The work that the American Engineering Standards Committee and associated technical societies have undertaken towards obtaining more efficient drafting room practice, might well have the active co-operation of the Mechanical Division, American Railway Association, and also the Railroad Division of the American Society of Mechanical Engineers, either by representation on the sectional committee or by committees within their own organization. It is essential that both the railroad and railroad supply industries be represented in any project to standardize drafting room practice and for that reason the Railroad Division is included among those interested, although the A.S.M.E. is represented as a society. In any case, an opportunity for constructive action towards better drafting room practice is too important for either the railroad or railroad supply industries to overlook.

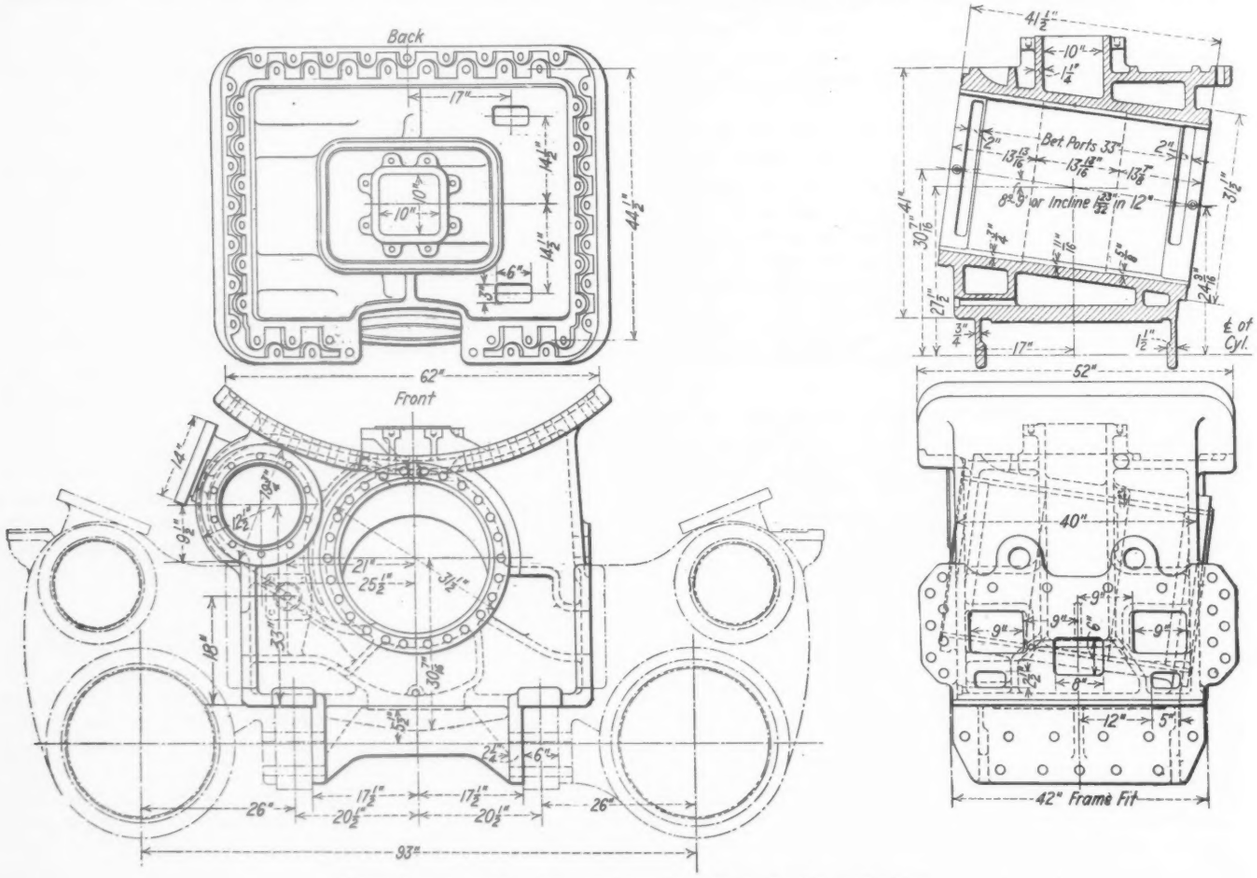


Three-cylinder Mountain type locomotive built for the Denver & Rio Grande Western by the Baldwin Locomotive Works

D. & R. G. W. buys ten three-cylinder locomotives

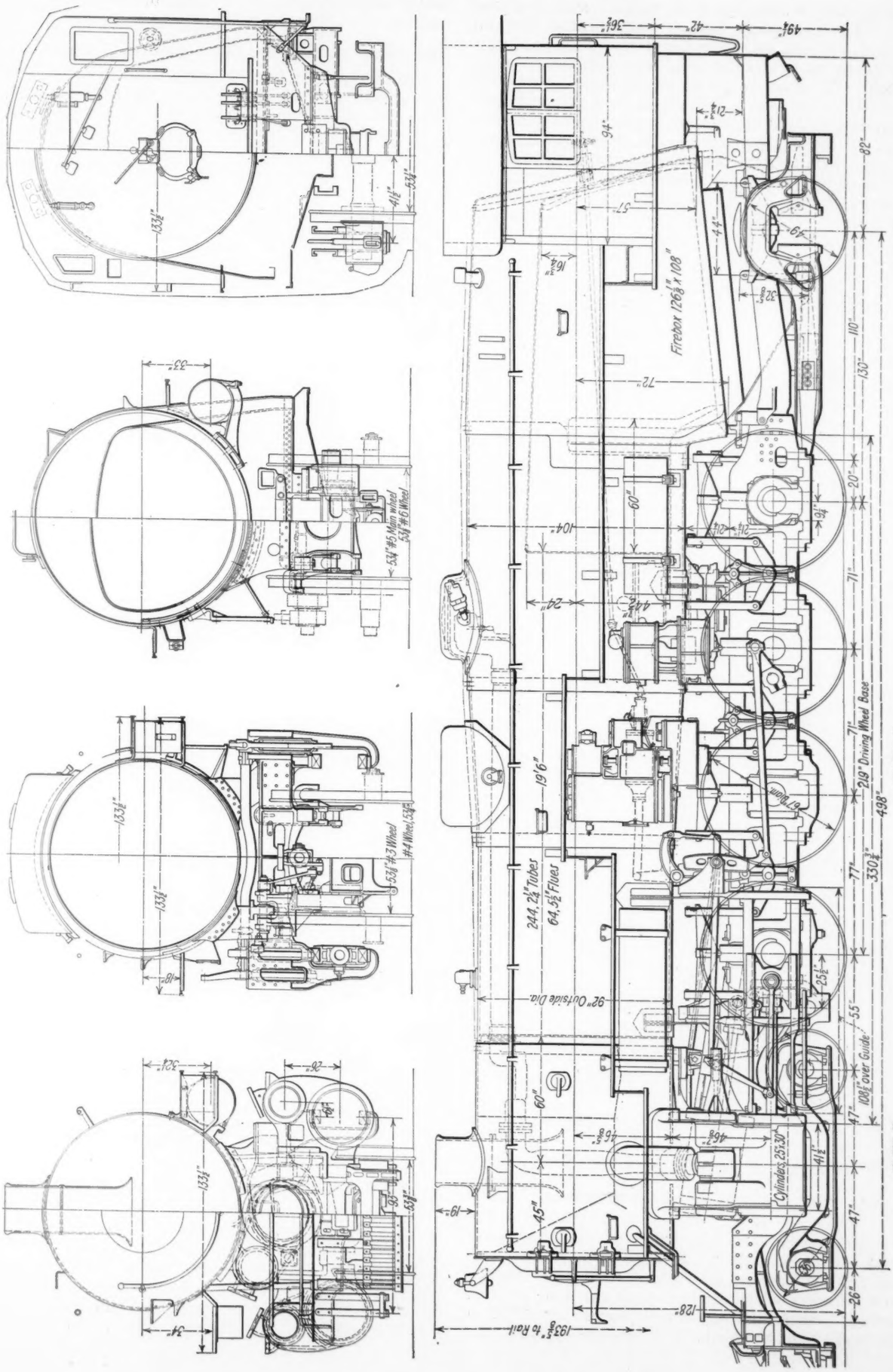
Designed to obtain maximum capacity in 4-8-2 type for heavy passenger service

THE Baldwin Locomotive Works has recently completed an order for ten three-cylinder locomotives for the Denver & Rio Grande Western. These locomotives, one of which was exhibited during the recent convention of the Mechanical Division of the American Railway Association at Atlantic City, are designed to meet the demands of unusually severe operating conditions over a road where the maximum grades are three per cent and the sharpest curves are 16 deg. They develop a maximum tractive force of 75,000 lb. which is exceptional for an eight-coupled design, giving these locomotives a hauling capacity that is exceeded by comparatively few locomotives in freight service.



Drawing showing the construction of the inside cylinders

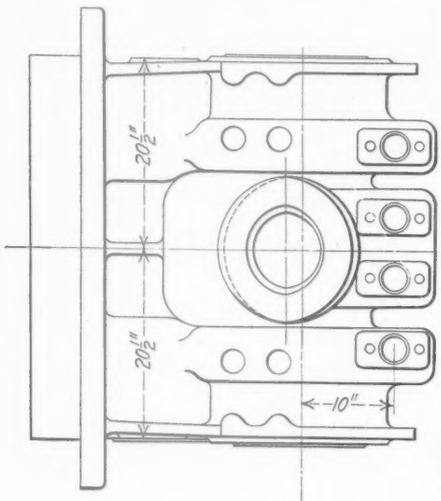
It was the aim of the designers to obtain maximum capacity in a coal-burning unit of the 4-8-2 type, with-



Elevation and cross section drawings of the Denver & Rio Grande Western three-cylinder Mountain type locomotive

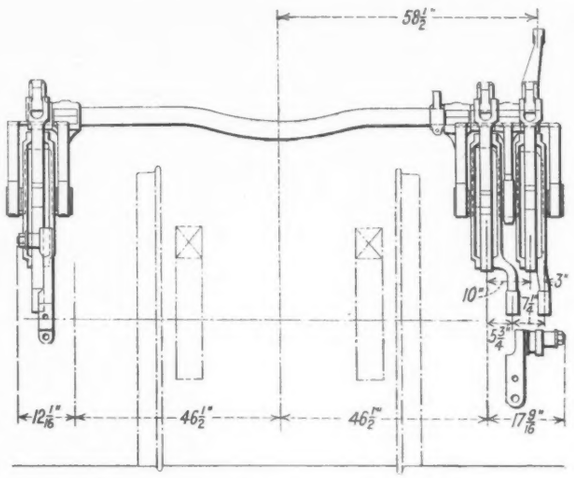
out exceeding certain specified weights and clearance limits. To accomplish this it was essential that all superfluous weight be omitted and the detail parts are consequently as light as is consistent with the required strength. The total weight of one of these locomotives is 419,310 lb., of which 290,530 lb. is distributed over the drivers, 67,880 lb. on the engine truck and 60,900 lb. on the trailing truck. All three cylinders are 25 in. by 30 in. and the outside diameter of the driving wheels is 67 in. The boiler pressure is 210 lb. per sq. in.

A novel feature in the design is the construction of the cylinders. The three cylinders are of cast iron and cast separate from each other, the center cylinder being cast in one piece with the saddle. Both sides of the center cylinder casting are flanged to receive the two outside cylinders which are cast from the same pattern. The front frame rails are single, measuring 6 in. in width by 13½ in. in depth. The outside cylinders are bolted securely to the rails and also to the center cylinder casting.



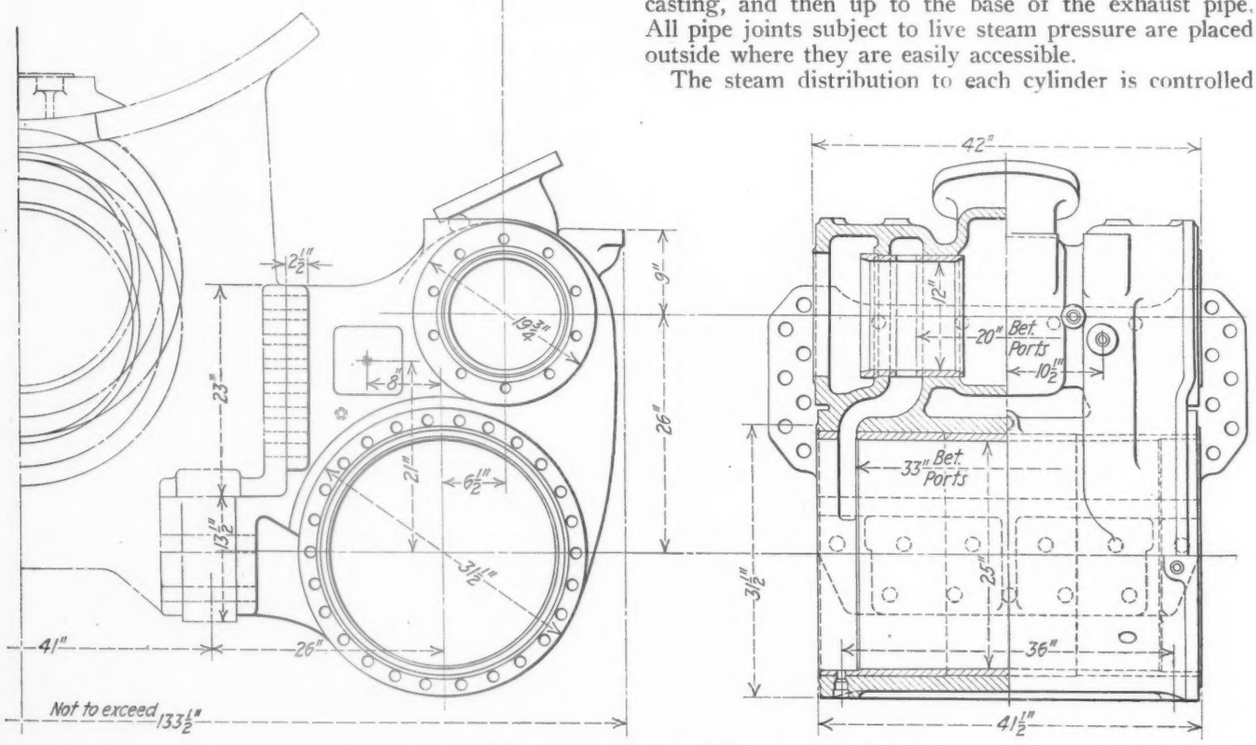
The three cylinders are cast separate from each other

The steam chest for the inside cylinder is placed on the right hand side and receives its steam supply from a branch leading from the right hand steam pipe. The location of this steam chest makes it necessary to run the exhaust passage for the right hand and inside cylinders underneath the latter to the left side of the casting, and then up to the base of the exhaust pipe. All pipe joints subject to live steam pressure are placed outside where they are easily accessible.



The horizontal shaft with left and right side connections

The steam distribution to each cylinder is controlled by a 12-in. piston valve having a steam lap of 1⅛ in. and an exhaust clearance of ¼ in. The valves are set with a travel of 6½ in. and a lead of ¼ in., and are controlled by a Walschaert gear. The motion on the left side is arranged in the usual way; but on the right side the main pin has attached to it a double return



Drawing showing the construction of the outside cylinders

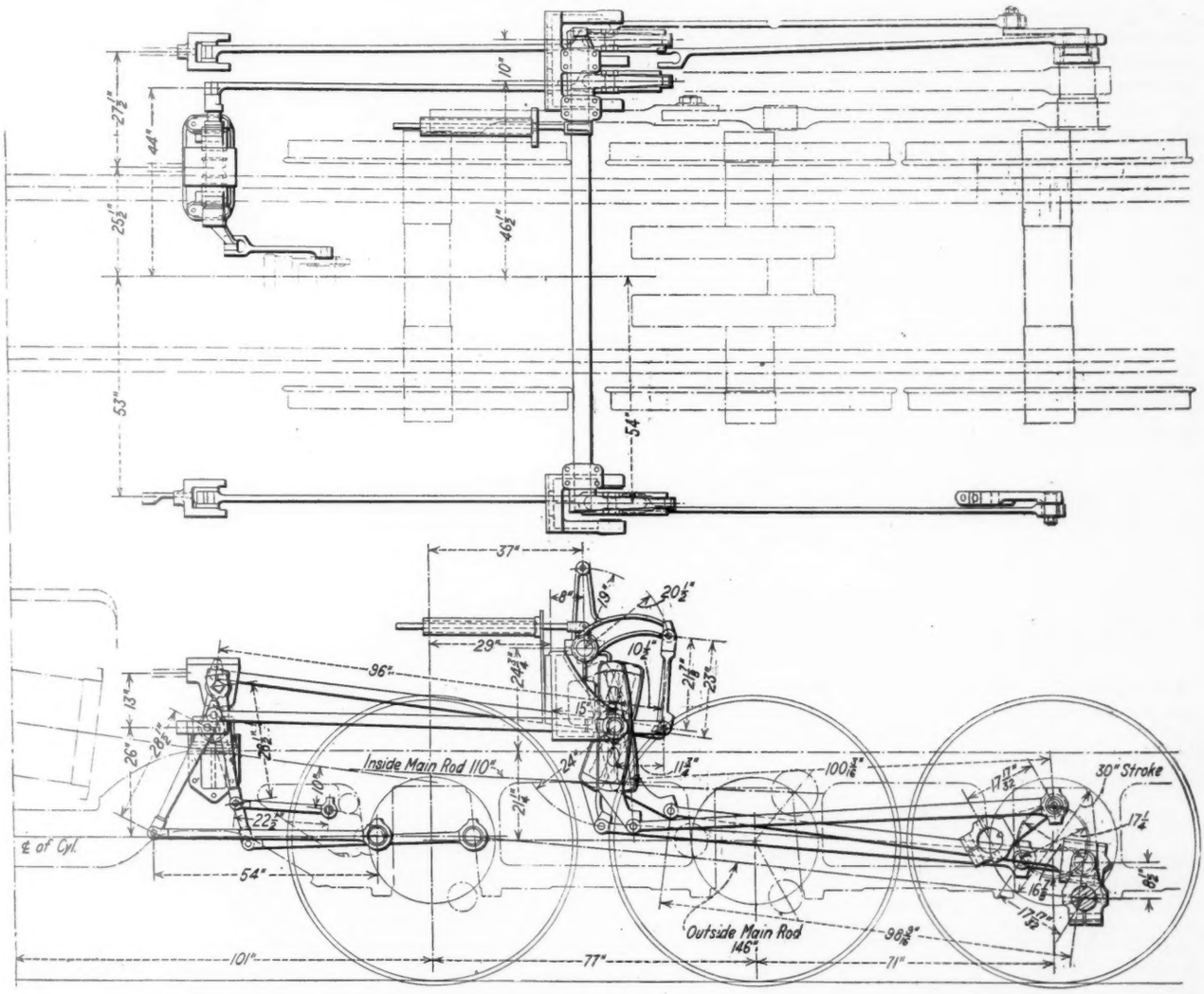
crank which operates two links, one for the inside cylinder and the other for the right hand outside cylinder. The inside valve receives its lead from the corresponding crosshead and the movement is transmitted from the plane of the latter to that of the outside link through a horizontal shaft which is fulcrumed in a rocker, the bearing of which is bolted to the main frames. This horizontal shaft passes through a crosshead to which the inside valve stem is attached. The three valve motions are controlled simultaneously by a power reverse mechanism.

The outside eccentric rod on the right hand side has a solid end of the usual design at the back end, while the inside rod necessarily has a split brass, which is held in place by a cap secured by two horizontal bolts.

bearers, placed respectively ahead of and behind the leading drivers. The lips of the inside guide, which take the pressure when backing up, are separate pieces secured to the upper shoe of the guide by vertical bolts. This form of construction is amply strong and facilitates machining the various parts.

The main and side rods are of I-section and made of carbon vanadium hammered steel, annealed. The crank pins are of the same material. Floating bushings are used on the main side rod pins and also on the back ends of the outside main rods. The back end of the inside main rod is of the strap type.

The crank axle, a product of the Standard Steel



Side and plan views of the Walschaert valve gear as designed for three-cylinder operation

The running gear

The piston of the inside cylinder is connected to the second pair of drivers and those of the two outside cylinders to the third pair. The outside crossheads are of the alligator type, while the inside one is of the underhung type, this design being used to provide sufficient clearance above the first driving axle. The outside guides and crossheads are unusually long, being 9 ft. ½ in. in length. The guides are supported by two

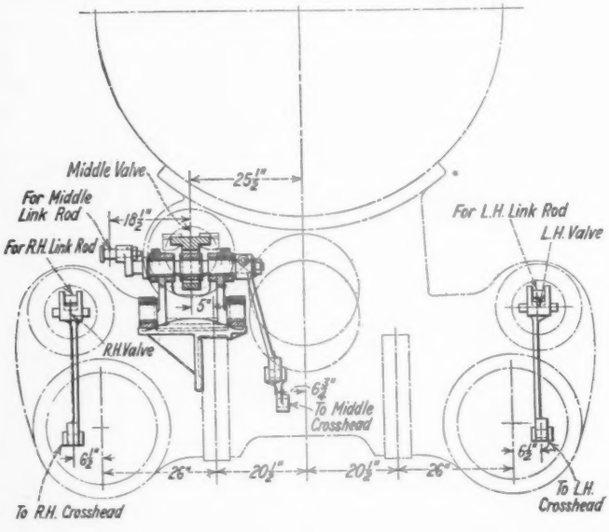
Works Company, Philadelphia, Pa., is of the built up type in five parts; two end pieces, two crank cheeks and the center pin. The pin and axle portions are of normalized carbon vanadium steel and the crank cheeks are of open hearth carbon steel. Cast steel counterweights, filled with lead, are bolted to the cheeks. The three other driving axles are of carbon vanadium steel.

The engine truck is of the Commonwealth constant resistance type and the trailing truck is of the Delta type.

The boiler, apart from its large dimensions, represents no unusual features of design. It is of the conical type,

92 in. outside diameter at the first course and 104 in. outside diameter at the dome course. The firebox is of corresponding size and volume, having a length of 126⅛ in. and a width of 108 in. which makes a grate area of 95 sq. ft. The depth from the crown sheet to the grate surface at the front of the firebox is 96 in.; it is 73¾ in. at the back. There are 244 flues 2¼ in. in diameter and 64 tubes 5½ in. in diameter, the distance over the tube sheets being 19 ft. 6 in. The total evaporative heating surface is 5,093 sq. ft. of which 402 sq. ft. is in the firebox and 5-ft. combustion chamber, 4,581 sq. ft. in the tubes and flues and 25 sq. ft. and 85 sq. ft. in the arch tubes and thermic syphons, respectively. The superheating surface is 1,495 sq. ft.

The boiler accessories include a superheater having 64 elements, two thermic syphons and du Pont-Simplex stokers. The brick arch is supported on the two syphons and three arch tubes. Five of the locomotives are equipped with Worthington feedwater heaters and the other five with the Elesco. The water level is shown by a Sargent three-face water gage. Barco



Cross section of the valve gear mechanism for the inside cylinder

joints are used in the connections between the engine and tender.

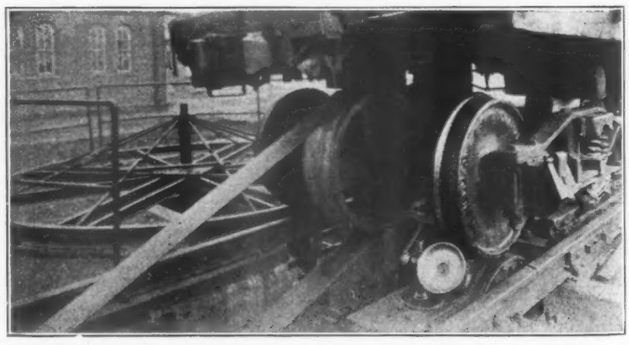
The tender

The stoker engine is mounted on the forward end of the tender instead of on the locomotive, as is the usual practice. The tender, which weighs 297,090 lb. in working order, has a capacity for 15,000 gal. of water and 25 tons of coal. The tank is of rectangular or water leg construction. The trucks are of the six-wheel type, having 36-in. diameter wheels and 6-in. by 11-in. journals.

The builders were assisted in the design of the locomotives by collaboration on the part of J. S. Pyeatt, president, and W. J. O'Neill, general mechanical superintendent, of the Denver & Rio Grande Western.

Table of dimensions, weights and proportions

Railroad	Denver & Rio Grande Western
Builder	Baldwin Locomotive Works
Type of locomotive	4-8-2
Service	Heavy passenger
Cylinders, diameter and stroke	(3) 25 in. by 30 in.
Valve gear, type	Walschaert
Valves, piston type, size	12 in.
Maximum travel	6½ in.
Outside lap	1⅛ in.
Exhaust clearance	¼ in.
Lead in full gear	¼ in.
Weights in working order:	
On drivers	290,530 lb.
On front truck	67,880 lb.
On trailing truck	60,900 lb.
Total engine	419,310 lb.
Total engine and tender	716,400 lb.
Wheel bases:	
Driving	18 ft. 3 in.
Rigid	11 ft. 10 in.
Total engine	41 ft. 6 in.
Total engine and tender	86 ft. 5 in.
Wheels, diameter outside tires:	
Driving	67 in.
Front truck	36 in.
Trailing truck	49 in.
Journals, diameter and length:	
Driving	11½ in. by 14¼ in.
Front truck	7 in. by 14 in.
Trailing truck	9 in. by 16 in.
Boiler:	
Type	Conical
Steam pressure	210 lb.
Fuel, kind	Bituminous
Diameter, first ring, inside	90¼ in.
Firebox, length and width	126⅛ in. by 108 in.
Combustion chamber, length	60 in.
Flues, number and diameter	64—5½ in.
Tubes, number and diameter	244—2¼ in.
Length over tube sheets	19 ft. 6 in.
Grate area	95 sq. ft.
Heating surfaces:	
Firebox and comb. chamber	402 sq. ft.
Arch tubes	25 sq. ft.
Thermic syphons	85 sq. ft.
Tubes and flues	4,581 sq. ft.
Total evaporative	5,093 sq. ft.
Superheating	1,495 sq. ft.
Comb. evaporative and superheating	6,588 sq. ft.
Special equipment:	
Feedwater heater	Worthington (5) Elesco (5)
Stoker	du Pont-Simplex, Type B
Tender:	
Water capacity	15,000 gal.
Fuel capacity	25 tons
Journals, diameter and length	6 in. by 11 in.
General data estimated:	
Rated tractive force, 85 per cent.	75,000 lb.
Factor of adhesion	3.88
Cylinder horsepower (Cole)	3,547
Weight proportions:	
Weight on drivers÷total weight engine, per cent.	69.4
Weight on drivers÷tractive force	3.88
Total weight engine÷cylinder hp.	118
Total weight engine÷comb. heating surface	63.8
Boiler proportions:	
Comb. heat. surface÷cylinder hp. per cent.	1.85
Tractive force÷comb. heat. surface	11.4
Tractive force X diam. drivers÷comb. heat. surface	763
Cylinder hp.÷grate area	37.4
Firebox heat. surface÷grate area	5.4



Testing device at Purdue University designed to record the impacts delivered by various lengths of flat spots on car wheels

The car is blocked in position, the wheel with the flat spots rides on a circular revolving track, below which is an indicating apparatus. The mating wheel is carried on an idler. The axle is belted to a motor which may be operated at various speeds. The car is loaded to any desired capacity; the blow delivered by the flat spot is recorded by means of a manograph on a sensitized plate.

Henry Ford and his philosophy*

The third of a series of discussions of books on improved supervision and better employee relations

A MECHANICAL superintendent recently sent us a copy of Mr. Ford's book, "Today and Tomorrow," with the notation, "You will enjoy this—the man problem is much discussed."

The book is more than ordinarily attractive because of the typography; the large type makes for easy reading and the wide margins invite the penciling of notes and comments.

We listened recently to an expert speaking on what to us, at least, and the audience at large, was a most important topic. He held his listeners spell-bound for the first few minutes, but soon got on their nerves because he spoke in such a cocksure fashion and hurled a steady stream of words at us in a loud and high-geared voice. It soon became evident—to the audience, not to the speaker—that they could not stand the strain of trying to assimilate so much good material under such strenuous conditions.

It is hardly fair to apply this criticism to Mr. Ford's book, and yet when we find him emphasizing the extent to which we can improve our practices in almost every respect and pointedly illustrating his statements by citing results obtained with his organization in operating a considerable number and variety of industries; running a railroad; working a farm; building, equipping and operating a hospital; educating our young people and workers in industry, or using our spare time for improvement, it does sort of get on our nerves. Possibly, after all, however, this is a good thing, for usually it is the man who is dissatisfied with his performances and recognizes his shortcomings, that opens up his mind and bucks the line with renewed energy and intelligence. While Mr. Ford does take a good bit of space in explaining his theories or philosophy, we cannot dismiss him as being a theorist, for he has made good to a remarkable degree in his various activities. Indeed one thing that makes the book attractive and fascinating is that he supports his statements of principles with specific examples of accomplishment.

What are his principles? His chapter on "Making a Railroad Pay" is interesting reading for a railroader, although, even Mr. Ford admits that there are special conditions favorable to the D. T. & I. under his ownership. He does in this chapter, however, take the opportunity of summing up or compressing into three statements what he regards as the Ford principle of management. These are:

(1) Do the job in the most direct fashion, without bothering with red tape or any of the ordinary divisions of authority.

(2) Pay every man well—not less than $6 a day—and see that he is employed all the time through 48 hours a week and no longer.

(3) Put all machinery in the best possible condition. Keep it that way and insist upon absolute cleanliness everywhere, in order that a man may learn to respect his tools, his surroundings and himself.

The early pioneers in the field of industrial economics were discredited, to say the least, when they advocated the payment of high wages and low selling prices—in other words, putting the wage earner in a position to buy the products which he makes and to raise his standard of living. "It is this thought of enlarged buying power by paying high wages and the selling at low prices, which is behind the prosperity of this country," says Mr. Ford. Again, in his chapter on "Is There a Limit to Big Business," he says: "But by sharing the profits with the public comes an immediate and great public benefit, there is a stimulating reaction on business, prices go lower, business increases, thousands of men are employed where but scores found work before, wages increase, profits mount."

The problem comes right back on the shoulders of management, because it must devise ways and means of increasing unit production and reducing costs. Several factors are involved in bringing this about and it is impossible in a review of this sort to even touch upon all of them. For one thing methods must be found "by which the entirety may be done by machinery and the man considered only as an attendant upon the machine." . . . "The function of the machine is to liberate man from practical burdens and release his energies to the building of his intellectual and spiritual powers for conquests in the field of thought and higher action. The machine is the symbol of man's mastery of his environment. One has only to go to other lands to see that the only slave left on earth is man minus the machine."

Then, too, it is necessary to secure cheap power and utilize it to the best advantage. "In the organization of the Ford work we are continually reaching out for more and more developed power. We go to the coal fields, to the streams, and to the rivers, always seeking some cheap and convenient source of power which we can transform into electricity, take to the machine, increase the output of the workers, raise their wages, and lower the price to the public."

Another vital factor in Mr. Ford's success is that of standardization and simplification. "No factory is large enough to make two kinds of products," he says. "Our organization is not large enough to make two kinds of motor cars under the same roof." Mr. Ford's one objective is to make a low priced, serviceable car.

The technical man is not highly favored by Mr. Ford, at least in administrative positions. "We call in technical experts," he says, "to aid whenever their aid seems necessary, but no operation is ever directed by a technician, for always he knows far too many things that can't be done. Our invariable reply to 'It can't be done' is 'Go do it.'" And then he goes on to tell how he has worked wonders in improving on the way other people do things, using what he characterizes as "essentially the Edison method of trial and error."

Possibly this review can best be closed with the following quotation: "This work is never more than a man can do without undue fatigue in eight hours. He is well paid—and he works. When management becomes a problem, the fault will be found to be with the planning of the work. Of course, if men are under some outside influence or control, by which the amount of work which they do in a day is limited—if they have to answer to an outside authority—then management is impossible, and consequently, high wages cannot be paid for the production of low priced articles. The whole wage motive fails."

* Today and Tomorrow. By Henry Ford in collaboration with Samuel Crowther. 281 pages, 6¼ in. by 9½ in. Bound in cloth. Published by Doubleday, Page & Co., Garden City, N. Y. Price $3.50.

The locomotive of tomorrow

The concluding installment of the papers presented in the Traveling Engineers' symposium at the 1926 convention

IN the October number of the *Railway Mechanical Engineer*, page 590, there appeared an account of the symposium on the Locomotive of Today to which the entire second day of the convention of the Traveling Engineers' Association, held at Chicago, September 14 to 17, was devoted. In that article appeared abstracts of the papers presented by W. E. Woodard, vice-president, Lima Locomotive Works; J. B. Ennis, vice-president, American Locomotive Company; A. R. Ayres, assistant general manager, New York, Chicago & St. Louis, and O. S. Jackson, superintendent of motive power and machinery, Union Pacific. These papers essentially dealt with the characteristics of the modern locomotive as it exemplifies the most recently approved developments of the designer, the results which are being obtained in practice by the use of this modern motive power and the best methods of utilizing fully the capacity for service.

In this article are grouped abstracts of the papers presented by W. L. Bean, mechanical manager, New York, New Haven & Hartford; C. T. Ripley, chief mechanical engineer, Atchison, Topeka & Santa Fe; A. G. Trumbull, chief mechanical engineer, Erie, and John E. Muhlfeld, consulting engineer. These papers may broadly be characterized as dealing, first, with some of the important mechanical problems of detail design which are in need of consideration and, second, with the possibilities for the future development of the steam locomotive which are partially suggested by the present trend of development and partially by fundamental considerations of the transfer and utilization of heat. Taken together, these papers present a remarkable picture of a new era in steam locomotive development, the beginning of which took place not more than four years ago. When it will end or where it will lead is not yet entirely clear, but some indication of its trend may be obtained from the papers which follow.

High tractive effort no longer the only consideration

By W. L. Bean

Mechanical manager, New York, New Haven & Hartford

Former consideration of steam locomotive capacity was almost exclusively on a tractive effort basis, especially by operating officers, and although starting effort should be ample, a locomotive with high starting capacity alone and limited sustained boiler capacity and large cylinders shows up poorly on a *speed-tractive effort* curve or on a *speed-drawbar horsepower* curve. In the days of drag freight operation, the considerations were tractive effort and gross tons, but now they are drawbar horsepower and gross ton miles per train hour.

To produce capacity and economy, under such requirements, additions and refinements utilized in recent years with marked success are those which in principle and practice, particularly in steam production have contributed to advantageous operation of central stations.

Crowded clearances and restrictive weights tax the skill and courage of the locomotive designer heavily in successfully adapting stokers, water tube fireboxes, feedwater heaters, superheaters, "front end" throttles, etc., to a large locomotive but great progress has been made.

Superheating is accepted by managements even to the revamping of older power with increased capacity and economy. Now through experience and further study the designer can utilize improvements in superheating which produce decided further advantages, especially where sustained horsepower at speeds is a requisite.

Augmented superheating surfaces with increased cross section of both gas and steam passages produce surprising results in increased maximum horsepower as well as greater horsepower at faster speeds. High evaporative rates in large locomotives, with relatively short distances between water surface and dry pipe opening produce wet steam. Hence the need for large superheater areas to produce higher average steam temperatures, as well as the other advantages.

Feedwater heating on locomotives fills in an important gap in the heat cycle and yields large returns proportionate to the investment and maintenance cost both through fuel economy and increased boiler capacity. What engineer would consider designing a stationary or marine boiler plant and not use feedwater heaters? Also less foreign matter enters the boiler, and tank capacity is proportionately increased.

Agreement as to application of stokers on heavy power is general and devices currently offered are well designed, are of ample capacity and dependable.

Of interest largely from the maintenance standpoint, integral cast steel versus fabricated constructions yield good returns. Every bolt, nut, key, rivet, pin, or other separate member eliminated initially means trouble and expense avoided. Per cent of availability of power is increased; hazard of accidents reduced; length of total life of members increased. A comparison of the life of tender frames alone is striking.

Unquestionably the next great line of development will be the use of higher steam pressures through water tube construction. Locomotive practice trails that of the central station and even the steamship badly in this respect. Inspection of steam-temperature data shows clearly the advantage of high pressures. Radical design changes not only of the firebox but of construction for absorption of heat by convection are required for handling high boiler pressures. Firebox construction of tubes, drums and hollow foundation ring already service-tested permit of moderate increases in pressure with present boiler barrel constructions, but full utilization means general redesign and hence probably considerable experimentation.

It is recalled that 20 to 35 years ago pressures of 220 to 230 lb. were general with compounding. When the superheater became available and a return to single expansion was made motive power men were glad enough to lower boiler pressures back to 180 to 200 lb. because of maintenance problems with stay-bolted construction.

Now the trend of pressures is very properly headed the other way and while working out the problems of design (including compounding with all its difficulties) in using probably from 600 to 1,800 lb. pressure we can quickly avail ourselves of considerable advantage though using water tube fireboxes already time tried with pressures up to approximately 350 pounds.

One carrier operates two Mikados of 45,000 lb. tractive effort and with 200 lb. pressure built in 1916 and giving good results. It has another, or a Mountain type of 250 lb. pressure built in 1924 and producing splendid results. Recently it placed in service 10 large Mountain types, three of which have three cylinders and all have water tube fireboxes and carry 265 lb. pressure. Further purchases of new power will unquestionably be of water tube construction. These latest 10 engines are doing excellent work particularly those with three cylinders.

A designer of high powered engines will include, among other important factors the following: *A* Higher boiler pressure, *B* Improved type of superheater, including ample and properly proportioned evaporating and superheating areas, *C* Grate area and grate design, D Firebox volume, *E* Special devices for promoting the extent and distribution of circulation of water, *F* Steam storage space (which is small at best), *G* Ample water surface for steam release, *H* Outside dry pipe and front end throttle, *I* Use of superheated steam in stoker engine, air compressor, feed pump and other auxiliaries, *J* Ample cross section areas for steam and gas passage, *K* Limited cut off, *L* Booster, *M* Back pressure gages, *N* Pyrometer, *O* Special care to eliminate air leaks into smoke box, *P* Tender capacities of maximum water and coal capacities.

The last decade has seen remarkable progress in locomotive design leading to new and surprising records of performance almost daily, and with our impetus and continued application of the skill and endeavors of engineers of the locomotive builders, specialty companies and of railroads, one cannot safely venture a prediction of accomplishments to ensue.

The road foreman of engines is a very important factor in capitalizing to the full the opportunities at his command. Continued instruction of enginemen, explanation, demonstration and encouragement in the full and correct use of improved devices are indispensable. Therefore the road foreman by keeping himself fully up-to-date will enhance his value and get keen satisfaction from full accomplishment.

Some details that must not be overlooked

By C. T. Ripley

Chief mechanical engineer, Atchison, Topeka & Santa Fe

There is a temptation for the mechanical engineer to devote too much attention to the consideration of major developments in new locomotives. They are naturally the most interesting and the results are the most spectacular. I do not mean to deprecate their importance, for wonderful things have been and are being done toward improving the thermal efficiency of the modern locomotive. But the essential requirement of a locomotive is that it get over the line without failure. It, therefore, behooves all of us to devote our efforts to accomplishing this result.

Let us first consider the firebox of the locomotive: The grates have been too often looked upon as a finished design. In recent years a number of roads, including our own, have been making an intensive study of the question of grate design and a large field for improvement has been found. I would like here to call attention to the development of the various designs of table grate. This change from the old finger grate is resulting in not only a fuel saving but in much lower maintenance cost. Better distribution of air through the fuel bed means easier and better firing of the locomotive. I am not sure but what a still further step in advance can be made by the introduction of alloy steel in these grates. In the case of oil burners there has been little change in design in the past 20 years, but studies are now being made as to different methods of introducing free air and it appears that by breaking up this air into a large number of small streams, better combustion can be secured.

Expansion stresses in the firebox

The greatest problem we have to meet in the large modern locomotive fireboxes with long combustion chambers, is that of staybolt breakage. The expansion and contraction of the sheets is so great that even the flexible staybolt does not entirely take care of the situation. Just how this is going to be met, I hesitate to predict. The double end flexible bolts may be of help but I am inclined to think that a more intensive study of the movement of the sheets may lead us to some changes in design which will prove of benefit.

In the case of the flues, the electric welding in the sheets has proved to be a marvelous help, but we are still troubled with heavy pitting of flues in bad water districts in spite of all the advances in water treatment. Much study is being given to the protection of flues when engines are laid up for long periods. There are indications that flues deteriorate about as rapidly when laid up as when in service. The methods used by the navy in protecting flues when ships are tied up may be of help in this connection. Storage with the boiler filled with water is preferable to our present practice where weather conditions will permit. Possibly rust inhibitive solutions will answer the requirements.

The front end—a new viewpoint

Passing on to the front end of the locomotive we have a part which is most vital to both thermal and operating efficiency. There are entirely too many air leaks in the front ends. If a water test is put on the front end of an engine just leaving the shop it is surprising to find the number of leaks. We must do everything possible to close up these openings. If we can get rid of the superheater damper, and this is being done on many locomotives without apparent damage to the superheater units, we will eliminate one aggravating source of leak. Better designs of steam pipe casings are being installed. In some of these designs there is practically no chance for leakage.

There is also a tendency to put too much in the front end; we may perhaps learn from the European designers in this connection. The simplicity of their front ends is the most notable feature of their design. Intensive experiments during the past few years have shown us that we can greatly improve the drafting of the locomotive. The low nozzle stand and the large stack are working out very well. In the case of the nozzle itself, the common standard single nozzle has a distinct drawback in that cross fire of the exhaust from the two cylinders produces a hump in the back pressure line which means loss of power. To overcome this there has been developed a double nozzle which has two separate outlets for each cylinder. This results in

the elimination of the increase in back pressure due to crossfiring. The engines are easier to fire and can handle more tonnage and save a small amount in fuel. This device is cheap to install and has no additional maintenance cost.

Too much water is carried over into the steam pipes of large locomotives, particularly those operating in bad water territory and equipped with feed water heaters. The superheaters are made to serve as evaporators and it is surprising to find the low steam temperatures existing at the cylinders in some of our locomotives. Some device is needed to take this water out of the steam. It has been accomplished abroad but on much smaller locomotives.

Frames and moving parts

The frames of the locomotives of older types are entirely too weak for modern service, and, as you all know, failures due to breakage have been common. These should be redesigned with larger sections and as engines pass through the shops they should be re-framed. Unfortunately the designer has a difficult problem in figuring the stresses in frames. All the formulas are more or less empirical and the best guide we have is the record of breakages. It might be well in this connection to take strain gage readings on frames while in service. I believe this would develop the fact that certain portions of the frames are under-stressed and certain portions over-stressed. With this knowledge available we could re-design the frames with the proper distribution of metal. Proper cross bracing of the frames is extremely important in the prevention of frame breakage. The cast steel engine bed which is now being tried out appears to be a very promising development.

In the case of the cylinders our efforts should be directed toward reducing the weight of the moving parts and thus helping lubrication, wear, breakage of parts and proper counter balances. Recent experiments indicate that we can cut the weight of piston heads, rings, etc., from 25 to 50 per cent. We should also cut the weight of the valve motion parts as much as is consistent with the prevention of breakage. It is possible that alloy steel may play an important part in this connection, although in the consideration of alloy steel we must always remember the difficulty of handling this material in railroad blacksmith shops as at present equipped. The future may change this equipment and thus meet this objection.

The need of cross-counterbalancing

In connection with the counterbalancing of the locomotive the track stress tests which have been run in the past few years have developed a very striking fact, that is, the main wheels of our heavy locomotives are improperly balanced under the standard A.R.A. formula. The tests show that the hammer blow on the rail under the main driver occurs when the counterbalance is up, rather than when it is down. This shows that these wheels are not balanced even for revolving weights. The reason for this is that the plane of the counterbalance and of the revolving weights is different. There is, therefore, a moment developed which has been given no consideration in the standard formula. The only correct way to counterbalance is to put a weight in the opposite wheel to take care of this moment. It may be of interest to you to know that a large Santa Fe type locomotive, when cross counterbalanced developed a practically zero hammer blow under the main driver at a speed of 45 miles per hour. The simplest way to approximate the same results is to add more counterbalance directly to each main wheel.

This study opens up a very interesting field for the designer. We are restricted by the track department to certain maximum loads per wheel. These restrictions usually are based on a combination of the static load and the dynamic augment or hammer blow. Now if by proper counterbalancing we can cut down this hammer blow we can increase the static load, thus we have an opportunity to develop the more powerful locomotive which requires higher axle loads without increasing the number of wheels. Incidentally we will get a smoother running locomotive which means lower maintenance cost.

While on this subject, I may note that these same tests developed the fact that the old idea of distributing the load equally over all drivers was incorrect. It was found that lower track stresses result, particularly on sharp curves, by tapering the load to the front and rear drivers.

The driving box is inadequate

One of the greatest weaknesses of our modern locomotive is the main driving box. You all know how quickly large locomotives develop a pound and what an expense it is to drop the wheels and correct the trouble. The fact of the matter is, the size of our locomotives has out-grown our driving box design. We have the main bearing on the top whereas the maximum pressure comes on the sides of the brass, lue to the thrust from the rod. Now how are we going to meet this?

As I see it, the most hope lies in the application of the floating bushing principle. You all know what an improvement has been made in the middle connection and back end main rod brass by the use of floating bushings. The principle of these bushings is fundamentally correct and I believe if the same principle can be applied to the driving box so that the thrust will come on different portions of the brass at different times, we will get a box which will run three or four times as long as the present design.

Lubrication will, of course, be a problem but I believe it can be solved by the pressure system. There has already been a design of floating bushing developed for engine truck boxes and its performance promises very well.

In mentioning engine trucks I wish to call your attention to the importance of this part of the locomotive. Falures due to hot engine trucks are the most common of all lubrication failures. We have been guided too much by old designs. At the present time much work is being done in the redesigning of the brasses, eliminating the slot and oil hole from the top, carrying the oil to the lower part of the brass. Attention is also being given the fact that a large part of the heat originates on the hub face. In this connection a better type of hub liner is necessary. Here again the floating principle appears applicable and is being worked out at the present time.

Bigger sand boxes are needed on large power. On some of our large power we now carry 3½ tons of sand. If the engineer has a plentiful supply of sand he can better protect his machinery.

A plea for a central testing bureau

In the case of the larger fuel saving devices the mechanical engineer is greatly in need of help. The average railroad does not have the equipment to test out these devices properly. The only place to test these devices properly is on a test plant and only one railroad

has such a plant. It is true we use dynamometer cars but the variables such as wind, weather, etc., make it almost impossible to draw entirely satisfactory conclusions, particularly when the percentage of difference is small. There is only one real solution for this condition and that is the establishment of a central testing laboratory under the jurisdiction of the A.R.A. A recommendation for such a testing bureau has been made to the Executive Committee but so far it has not seen fit to adopt it, but I sincerely hope that the day will come when we will all have the benefit of such a bureau.

From time to time the work performed by existing locomotives is being increased; this is made possible by higher boiler pressure and application of capacity increasing devices. As a result they are moving heavier trains and in most cases at a higher rate of speed. The major part of the locomotive mileage in the next few years will be made with existing locomotives, consequently the major item of importance is to make the locomotives we now have more reliable and more efficient machines. You who are continually in touch with the operation of these locomotives can be of a very great assistance in helping the mechanical engineer achieve these results. He must rely on you for first hand information as to these conditions. You should make every possible suggestion as regards changes which can be made to better locomotives. If your criticism is constructive he will certainly welcome it and you will be doing an important part in improving the design of the locomotive on your line.

A big field for future development

By John E. Muhlfeld
Consulting Engineer

Considering the term "locomotive" broadly as relating to any kind of mobile machine used for transportation on land, my observations in several countries during the past few months indicate that the steam locomotive, after about a century of commercial service, is still the premier self-contained motive power for movement of passengers for relatively long distances, and of tonnage freight for both long and short hauls, and that it also provides the most comfortable means for traveling. I predict that with the inauguration of the many possible constructive and operative improvements, it will maintain this position for several generations to come.

We have in our most modern conventional types of steam locomotives a machine that, at its best, will produce from seven to eight per cent thermal efficiency in terms of the best value in the fuel fired. In average road service this percentage will be reduced to from four to six per cent.

Thing needed to double thermal efficiency

In order to double the prevailing thermal efficiency and bring it to about 15 per cent, I will offer the following suggestions for your serious consideration:

1—Steam of from 400 to 800 lb. boiler pressure, superheated so that the total temperature will not exceed 750 deg. F.
2—Multiple or a higher rate of expansion of the higher pressure superheated steam.
3—Better distribution and utilization of the steam in the cylinders.
4—Reduction in cylinder back pressure.
5—Reduction in loss of superheat from stack.
6—Reduction in loss of steam pressure between boiler and cylinders.
7—Reduction in moisture contents in saturated steam as delivered to the superheater.
8—Improved circulation of water in the boiler.
9—Greater volume of steam space in the boiler.
10—Improved combustion of fuel.
11—Greater utilization of products of combustion for evaporation and superheating.
12—Feedwater heating with both waste steam and gases.
13—Shorter rigid wheel base.
14—Greater utilization of engine and tender total weight as adhesive weight for starting, acceleration and running and to negotiate ruling grades.
15—Reduction in dynamic augment in preference to reduction in axle loading.
16—Greater accessibility of boiler and machinery parts.
17—Reduction in number of detail parts and accessories subject to wear, failure and breakage.
18—Reduction in smoke, cinders and noise.
19—Automatic force-feed lubricators for valves, cylinders, stokers, air pump and feedwater heater.

The natural question is "How can this all be done and how much is it going to cost?" From my recent observations in Europe and what we have learned from the "Horatio Allen," a 350-lb. pressure, crosscompound locomotive, in road freight service on the Delaware & Hudson during the past two years, it is my opinion that these results can be obtained at a reasonable investment cost along the following lines:

1—Combination water and fire tube boiler which will eliminate the existing conventional crown and side sheet type of firebox and substantially increase the firebox evaporation surface.
2—Improved fire-tube superheater which will substantially reduce existing resistance to the flow of steam.
3—Combinations of one or two main high and low pressure cylinders, all placed outside of the engine frames.
4—Poppet valves and improved valve gear all disposed outside of the frames.
5—Radical change in exhaust nozzle and smokebox draft appliances, including an automatic variable nozzle.
6—Removal of dry pipe, throttle valve and superheater header outside of the boiler and smokebox.
7—Enlarged and unobstructed passages throughout the boiler particularly at the furnace end, to provide free circulation and ebullition and increased saturated steam space.
8—Self-contained equipment on the engine and tender to provide for preparation and burning of either solid or liquid fuels in suspension.
9—Production of a greater percentage of saturated steam at the furnace end of the boiler.
10—Better distribution of flow of products of combustion around and through the evaporation surfaces and as between evaporation and superheating surfaces.
11—Combination waste steam and flue gas feedwater heaters.
12—Reduced total weight of engine and driving axle load per pound of tractive force.
13—Elimination of all unnecessary leading and trailing wheels.
14—Use of high elastic limit steel castings or forgings to reduce unsprung weight in driving axles, wheel centers and main and side rods, as well as in other revolving and reciprocating parts.
15—Make the basic design of the boiler and machinery such as will provide maximum power, efficiency and economy without the use of unnecessary dead weight and complication in accessory equipment.
16—Adequate counterbalance in each driving wheel, keeping the centers of gravity of the planes of revolving and reciprocating parts as close as possible to the planes in which the counterweights revolve.

The foregoing seems like a large order, but representative European and American railway engineers have agreed that such changes can and should be made in the future American steam locomotive, which will have a life of from forty to many more years. These changes will bring its thermal efficiency up to that of the self-contained Diesel or internal combustion engine and far beyond that of the electric locomotive, at much less investment, maintenance and operating cost per unit of power developed.

It is well to remember in this comparison that the governing factors in producing efficient and economical hauling capacity in the steam locomotive is to overcome heat reduction and in the electric locomotive to prevent heat rise. Also that electric motor equipment has already reached a high state of efficiency, whereas the

possibilities of improving the efficiency of steam generation and utilization are almost unlimited.

"Horatio Allen" has proved its practicability

The "Horatio Allen" locomotive, which has been in regular road freight service on the Delaware & Hudson, between Oneonta and Mechanicsville, N. Y., during the past two years, has now made about 54,000 miles as a single-crewed and pooled engine. Nothing has developed in its road service or terminal handling that necessitates its being given other than the same attention received by other steam locomotives It has not made more mileage because of the repeated minor changes made in connection with the experimental and test work relating to the high pressure, steam distribution, multiple expansion and like factors. The boiler and the 350-lb. steam pressure have given remarkable results and another more simplified design is now under construction which will make use of 400-lb. boiler pressure and will be named the "John B. Jervis." This locomotive will be ready for service probably during November of this year.

Since the first locomotive testing plant was installed at Purdue University when I was a student there in 1891, several others have been built, those now in existence being notably at Purdue where the greatest amount of work has been done; at Altoona, on the Pennsylvania, and at the University of Illinois.

Subjects needing scientific investigation

We are sorely in need of definite scientific information relating to steam locomotive combustion, heat absorption in boiler, distribution and use of steam, reduction of cylinder back pressure, superheat, feed heating by waste steam and gases, boiler efficiency in relation to production and exhausting of steam and to intermittency of exhausts, relation of grate area to firebox volume and heating surface, the relation of fire flue to fire tube gas areas and of superheater element to fire flue areas, compounding, insulation, draft, combustion and cinder losses, furnace and flue gas temperatures, dynamic augment, and many other important factors in railway operation and maintenance. For example, water converts directly into steam at a temperature of about 700 deg. F. when under a pressure of about 3,000 lb. and steel will stand up under heavy pressures at a temperature of about 900 deg. F. We can, therefore, see the possibilities for further developments in the direction of steam temperatures and pressures.

In recently installed pulverized fuel burning central power stations, the heat in the fuel that is actually absorbed by the boiler and superheater will average 85 per cent and by the boiler, superheater and economizer 91 per cent. This performance is obtained with coal having about 12,600 B.t.u. over 2 per cent moisture, 35 per cent volatile, 51 per cent fixed carbon, and 11 per cent ash, and the CO_2 in the stack gases averages 15 per cent. In steam locomotive performance, with the best hand firing, we get a combined boiler and superheater performance of about 75 per cent and the average will run about 65 per cent.

A. R. A. needs modern testing plant

The foregoing is cited to show how much still remains to be done in steam locomotive boiler development and operation. The American Railway Association, Mechanical Division, should be provided with a centrally located modern locomotive and car testing plant which can be used by all member railroads and devoted to the scientific and unbiased research and study of the complete locomotives and cars, and of the detailed equipment, material and special appliances relating thereto. In this way correct designs and materials and the fundamental and the scientific laws governing locomotive and car operation and efficiency could be determined in a constructive, practical and economical manner. Then, by combining this information with that which can be obtained in the field with dynamometer cars on long runs and heavy grades, we can secure the fullest measure with respect to the drawbar pull and train resistance factors, in addition to the combustion and steam data which can be obtained both in the field and in the test plant.

Provided with such facilities and with unbiased facts as to the actual results of steam locomotive road operation, I have no hesitancy in saying that we could readily double the existing steam locomotive thermal efficiency and otherwise reduce the future fuel, water and other costs to the extent of hundreds of millions of dollars annually with a relatively small proportionate increase in the investment cost of the steam locomotives themselves.

Trends in locomotive development

By A. G. Trumbull
Chief mechanical engineer, Erie

The trend of development of the locomotive has been twofold—first, and most important, with respect to the boiler, and second, and of lesser importance, with respect to the engine. I place the boiler first because the principles underlying steam application have long been better understood than have those of economical generation, especially as applied to locomotives. Indeed, we are today without the basic facts upon which to design with certainty a locomotive boiler to produce most economically the maximum evaporation under varying service demands with a minimum fuel consumption. In this respect the stationary steam generation plants have long been models of scientifically efficient mechanical precision.

The most recent examples of current locomotive design have featured a relatively larger grate area than has heretofore been the accepted practice and this has naturally resulted in an increase in firebox volume which impresses me as offering the greatest opportunity still available for the economical utilization of coal in steam production.

More firebox volume

Those solid fuels having high percentages of volatile matter with which most of us are chiefly concerned, on being heated, give off the volatile portion in the form of a gas or as is commonly the case, a mixture of gas and fine particles of solid material. In order to secure combustion of the volatile gaseous portion of the fuel, it is necessary that it be mixed with a definite proportion of air heated to a high temperature; therefore a definite furnace volume is required above the grates which is the reason for the familiar difference in firebox construction between anthracite and bituminous coal burners.

All of the air required for the combustion of the volatile matter passes up through the fuel bed and as the rate of combustion per square foot of grate increases, the velocity of the air through the fuel bed must also increase, with a consequent tendency to carry small particles of the solid combustible above the fuel bed. It is possible under these circumstances to secure complete combustion both of the volatile and solid portions of the fuel, but if the furnace volume is insufficient, the gas, consisting of volatile combustible, air and fine particles of solid fuel may enter the flues where the temperature is likely to be reduced below the point at which the neces-

sary chemical union of the oxygen with other materials may take place and substantial losses thus occur in combustion efficiency.

It will be seen from these brief considerations that grate areas, furnace volume and air supply are essential factors in combustion. Moreover, in general, chemical processes are vitally influenced by the time element, those that are not hurried being likely to be most complete. In the case of the firebox, if the volume is sufficient and the grate area adequate, the velocity of the air and gases will be low enough to permit complete or nearly complete combustion with a maximum heat absorption or evaporation.

These principles have characterized the development of stationary boiler practice during the past few years, as will be observed from the accompanying table which shows the principal relations between the horsepower, per cent of normal horsepower developed, per cent of furnace volume per pound of coal burned, overall efficiency and other interesting factors indicating the influence of combustion volume upon boiler output. This table indicates that since 1905 with a hand-boiler the furnace volume per pound of coal fired has increased more than 4½ times with a stoker fired boiler and more than 7½ times with powdered fuel. The corresponding boiler ratings are 125 per cent, 275 per cent and 300 per cent respectively. It is of importance to note that this remarkable increase in capacity has been attained with an increase of more than 22 per cent in evaporation per pound of coal having a fixed heating value. This very extraordinary development in steam generation would appear to indicate that there are yet undeveloped possibilities in locomotive boiler capacities to be attained through the use of large grate areas combined with as high a ratio of furnace volume to grate area as is consistent with limiting clearance dimensions.

A locomotive of this description must of necessity have its firebox carried upon a trailing truck, thus materially increasing the non-adhesive weight and adding to the cost of maintenance and depreciation as well as to the original cost. However, these disadvantages should be more than offset by increased boiler output, the importance of which needs no emphasis. The hauling capacity of a locomotive at any speed is dependent on the steaming capacity of the boiler. Consequently, if the boiler can be proportioned to produce a greater volume of steam with a possibility of improved furnace economy, a locomotive of given proportions will either haul more cars or it will haul the same number of cars at increased speed, either of which will increase the available ton-miles per hour capacity of the locomotive, and that means reduced transportation cost.

Comparative proportions recent experimental and other locomotives

Engine	Type	Boiler press.	Tractive force	Evap. heating surf., sq. ft.	Grate area, sq. ft.	Ratio heating surf. to grate area	Firebox volume cu. ft.	Ratio firebox volume to grate area	Factor of adhesion
Horatio Allen	0-8-0 comp.	350	70,300	3,200	71.4	44.81	575	8.05	{ 3.25-S / 4.25-C }
Baldwin 60,000	4-10-2 comp.	350	82,500	5,192	82.56	62.89	735	8.9	4.10-C
Lima No. 1.....	2-8-4 sim.	240	69,400	5,110	100	51.1	515	5.15	3.58
N. Y. C. 8,000.....	2-8-2 sim.	210	66,700	3,676	70	52.5	372	5.3	3.72
Penna. I-1S.....	2-10-0 sim.	250	90,000	3,944	70	56.3	385	5.5	3.8

Trend of furnace development in stationary boiler service, central power plants

Year	Method of Firing	Size of boiler units in general use, hp.	Per cent of furn. vol. per lb. of coal compared with 1905	Per cent ra ing representing good practice	Per cent increase over 1905	Lb. coal per lb. water evaporated	Per cent decrease under 1905
1905	Hand	450	100	125	..	.1227	..
1910	Stoker	450	180.5	175	40	.1165	5
1915	Stoker	670	216	225	80	.1104	10
1920	Stoker	830	434	225	80	.1068	13
1925	Stoker	1,450	455	275	120	.1003	18
1925	Pulv. fuel	1,450	736	300	140	.0974	21

Higher boiler pressures are coming

The possibility of substantially increased economy through higher boiler pressure is a fundamental fact, the improvement being due to differences in the temperature of the steam. We do not ordinarily consider that a steam engine is essentially a means for the conversion of heat into mechanical force, but in an analysis of economies resulting from the use of steam it is necessary to proceed with heat units as a basis. The increase in efficiency is measured by the difference in the heat content of the steam at admission and the heat content at exhaust after expansion has occurred in the cylinder. That being so, if the initial pressure is increased through the application of additional heat, a relative increase in efficiency must result.

It is an interesting speculation as to what this trend may reach in the immediate future and we may pause to give it a moment's consideration. By 1935, if the present tendency continues, we shall have locomotives quite generally carrying 325 lb. to 350 lb. pressure. In view of the probable influence produced by the introduction of the water tube boiler, this roes not appear to be an unreasonable conclusion. On the contrary, there are some forward looking locomotive designers who predict that we shall ultimately reach pressures as high as 650 lb., but I am too much handicapped by the limitations arising out of practical experience to share so venturesome an opinion. In fact, such pressures appear highly improbable because of considerations both theoretical and practical. While there is an advantage to be gained through higher steam pressures than are now usually employed, the increased economy becomes progressively less as the pressure increases and at very high pressures the saving cannot be realized through simple expansion. Then, too, the difficulties of maintenance that may be imagined with excessively high pressures, even with a well designed water tube boiler, are too great to warrant the conclusion that such pressures are of practical application.

Compounding has a future

It is unfortunate, perhaps, that our experience with compound locomotives antedated the present tendency

to higher boiler pressures because the difficulties in maintenance and the operating problems they introduced are likely to retard the reintroduction of the compound, notwithstanding its economical possibilities. The compound for general service was originally introduced mainly for the purpose of preventing cylinder condensation, but with the successful development of the superheater this advantage disappeared and with it the train of difficulties still fresh of memory. However, the gain through a greater range in initial and exhaust pressures cannot be realized through the higher boiler pressures without using the compound principle, because in a single cylinder at long cutoffs, it is impossible to expand the steam down to the required exhaust pressure. This fact accounts for the use of the cross-compound design of the Horatio Allen. In the case of the Baldwin engine, however, the compound feature was probably introduced to secure the advantage of the three-cylinder arrangement and at the same time obtain the economy resulting from decreased heat losses in the cylinder walls produced by expanding the steam in two stages, that is in a high pressure and two low pressure cylinders.

In addition to the reduced cost of maintenance of this type of boiler which has been said to approximate 50 per cent, there has been great expectancy of relatively increased steaming capacity. The use in firebox construction of tubes and cylindrical drums in place of flat stayed surfaces, makes it possible to reduce the thickness of the material and this ought to favor heat transfer and consequently increase the evaporation per square foot of heating surface. Unfortunately there are no capacity tests of this type of boiler available; those which have been made were on relatively the same basis of boiler demand and show no increase in evaporation per unit of heating surface over boilers of the usual construction.

In addition to the anticipated gain through increased heat transfer, there is an undeniable advantage in improved circulation and also in the greater firebox volume attainable within the prescribed clearance limitations. These factors should produce a marked influence on the capacity and serviceability of the boiler.

The booster and limited cutoff as traction increasers

Now, with a boiler of any type designed to afford a maximum firebox volume, a considerable part of the weight will be transferred from the drivers at the expense of adhesion and right here a very important difference of opinion develops between locomotive designers. I believe this will disappear with the completion of the investigation of the service rendered and the economy developed by the experimental locomotives now in service. The situation is very well illustrated on the chart of comparisons between the Lima and Baldwin engines and the Horatio Allen. It will be observed that in the case of the Lima engine, the calculated ratio of adhesion is but 3.58, which is admittedly too low unless some compensating feature is introduced. This problem is met in two ways—first by the application of a booster to the trailer truck and second by the use of the limited compensated cutoff feature. Both aid materially in the production of maximum hauling capacity at slow speeds and the limited cutoff also greatly increases the cylinder horsepower at speeds.

It should be observed that with a fixed cutoff as short as 50 per cent, when the usual type of valve design is employed, at starting or at extremely slow speeds the main steam ports will not open and to meet this condition additional or so-called compensating ports have been introduced. The cutoff may be fixed without the use of compensation ports, but not at as high a figure as 50 per cent. With the ordinary type of valve gears, a fixed cutoff of 70 to 75 per cent can be secured by increasing the steam lap of the valve and by changing the ratio of the lap and lead lever to correspond with the increased valve lap. Incidentally, this measure affords a desirable means of improvement in existing locomotives, especially as it can be so readily accomplished.

Automatic cutoff control

The next feature of interest and value in locomotive operation contributing to increased efficiency and economy is cutoff control by means of back pressure which may be either manual or automatic. It has long been known that for each class of locomotive—and a distinction is here made between type and class—there is a point of cutoff for each speed that will produce a maximum hauling capacity. An attempt was made some years ago to apply this principle in practice by furnishing a card to enginemen on which the necessary information was given in table form but the plan failed of general adoption because it imposed too great a burden upon an already very busy engineman. The use of back pressure as a means of establishing maximum hauling capacity is, however, of comparatively recent application.

Other conditions being the same, back pressure varies directly with the admission pressure, cutoff and speed and for each class of locomotive there is a definite back pressure which if maintained at a constant figure will produce the maximum mean effective pressure with a cutoff proportional to the speed of operation. This back pressure is easy of determination by experiment and the locomotive may then be operated accordingly with every assurance that it is producing maximum power. Of course, the back pressure constant is correct only for the boiler pressure at which it is established which should be the normal one. The most general method of regulation is manual corresponding to the indications of a special back pressure gauge, but a mechanical control has been devised which if successfully developed will insure the nicety of regulation difficult of attainment where dependence must be placed upon the necessary constant manual manipulation.

From the foregoing considerations it seems reasonable to conclude that the high duty locomotive of today should have the following characteristics:

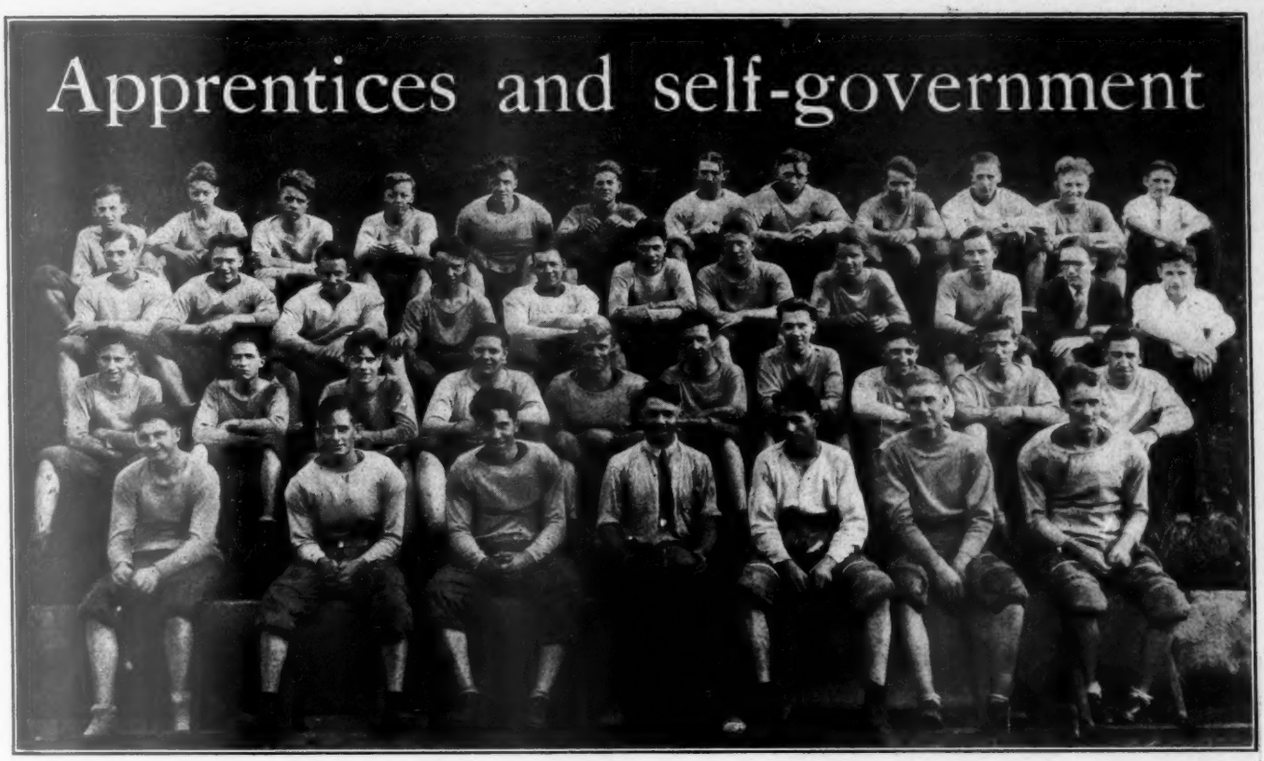
1—A boiler of the conventional type with considerably larger firebox volume than has been commonly used.
2—A steam pressure of 225 lb. to 250 lb.
3—A fixed maximum cutoff.
4—Means of increasing the hauling capacity at starting when it can be advantageously employed, which would naturally take the form of a booster applied where advantage may be taken of the maximum available non-adhesive weight.
5—Means to permit operation of the locomotive with a predetermined back pressure.

As to the future, it would appear that logical development may be expected to proceed along the following lines:

1—The extended use of water tube boilers, still utilizing the large firebox volume, and in the early stages, employing steam pressures up to 250 lb. per sq. in.
2—Increases in steam pressures up to 350 lb. per sq. in. as experience may dictate.
3—An extension of the use of compound engines to secure the advantage of the higher pressures, such engines being of the three and four cylinder type.

To those who regard these predictions as visionary it may be well to suggest that out of the misty fabric of the dreamer's visions, the substance has been fashioned of all the wonders that are now the everyday accompaniment of our material existence.

Apprentices and self-government



The 1926 apprentice football squad

CHARLES F. BAILEY, engineering director of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., presented an unusual paper on apprentice training at the Old Dominion Meeting of the American Society of Mechanical Engineers at Richmond, Va., in September. Several of the practices which have given excellent results at the Newport News plant will undoubtedly appeal to those railways which have been interested in improved apprentice training methods. This is particularly true of the self-government feature. The following extracts are from Mr. Bailey's paper.

The apprentices are in charge of instructors in the shops who assign their work and teach them the best ways to execute it. The boys in the pattern and the joiner shops are grouped largely by themselves, although in the other shops and aboard ships they are more scattered, but under instructors.

School work

For a period of approximately nine months yearly, during the second to the seventh terms (each term is six months) inclusive, sessions are held for study in the class rooms, thus intimately interweaving scholarship with shop work. Each apprentice attends two half-days each week during the regular working hours with pay. Teachers under the supervisor of apprentices conduct these classes. Monthly reports of the school room work and the shop work are made, rating each apprentice on his trade ability under the headings, *workmanship, accuracy, application, aptitude* and *skill.* Character is rated under the headings *interest, initiative, judgment, conduct* and *moral sense.* School work and shop work are rated by percentages. To a certain extent the apprentice teaching is aided under the provisions of the Smith-Hughes Act.

The practice of conducting the school during working hours is found, in the case of trade apprentices, to give the best results. The control is better and the co-ordination between shop and school work is closer than when the studies are given outside of working hours. With advanced students, where the opportunity is presented to attend evening technical classes, the problem is quite different. It is found, however, that some of the more ambitious and brighter apprentices will take evening classes in addition to their regular shop training and class work.

An artistic certificate is presented to the apprentice on the satisfactory completion of his course; a cash bonus of $100 is also given.

Promoting interest

Incentives are provided, such as distinguishing the benches by numbering to indicate excellent performance; posting the marks for public notice; presenting minor prizes in the form of tools or small gold pieces; citation or promotion for special effort or exceptional performance; the granting of scholarships in evening schools or in correspondence courses; and, as the highest reward, a scholarship allowing contingent expenses in some higher institution of learning for a period of one, two or more years. The incentives are so offered as to create a lively spirit of competition and it is intended to make them sufficiently numerous so as to encourage the slower, but well-meaning, boys.

Extraneous activities

Athletics constitute one of the principal activities outside of the working hours. The spirit of sport is encouraged by the management and particularly by the employment manager and the supervisor of apprentices, who co-operate and co-ordinate in all matters concerning the apprentices. The boys play the smaller colleges and the freshmen teams of some of the larger schools. Their

spirit of honor, fair play and manliness make them popular contestants. While in training they willingly forego smoking, with other restrictions, in order to better fit themselves to meet their contestants. This also applies to the boys in other activities, such as the band organization, where semi-weekly practice is maintained throughout the year, regardless of weather and handicaps.

The apprentices have fitted up a very attractive club room which is open for meetings of committees, the council or for interviews during the day. Each evening the club is open, the boys taking turns in assuming charge of the premises.

It is not intended to convey the idea that obstacles and difficulties are not encountered—there are many of them. Some of these have been satisfactorily solved by the boys themselves. As an example, a few weeks ago a group of six of the more influential apprentices desired to take a brief leadership course at Blue Ridge, North Carolina. They were assisted in this by the company, who paid a portion of their expenses. When they left for this training the supervisor propounded several questions of a hypothetical nature bearing on apprentice problems. These were carefully considered and worked out with such reasonable and practical answers that a number of them have already been put into effect with gratifying results. Other problems proposed by this group and now receiving attention are as follows: shop organization and discipline, improvement of social facilities, promotion of alumni interest, reception for probationers, review of qualifications of applicants, development of graduation exercises, publication of apprentice paper and year book.

Thrift is encouraged and practiced through an apprentice banking organization.

Apprentice band ready for rehearsal

Self-government

The government of the apprentice body is administered under a constitution adopted by the Apprentice Association which provides for self-government. The supreme authority rests in an honor council, composed of ten representatives from the various departments. The members are elected by and from the apprentices, and serve during the remainder of their apprenticeship or during good behavior. Election is by secret ballot. Meetings are held upon the call of the president or the supervisor of apprentices.

The council makes and executes all the rules and regulations governing the apprentices and acts as representative of the body. It settles grievances or complaints, provides for election and interprets the constitution and by-laws. The employment manager and the supervisor of apprentices are ex-officio members, in an advisory capacity, but without the right to vote. After election to the council the officers are duly installed by subscribing to a pledge administered by the supervisor of apprentices. This reads as follows: "I do solemnly promise to support the constitution of the apprentice body, and to perform the duties of my office to the best of my knowledge and ability."

All members of the apprentice council also take the following pledge: "I do solemnly promise to perform my duty to the best of my ability and if possible to the satisfaction of the apprentice body."

This form of government has proven most satisfactory and is considered one of the outstanding influences for good.

Not long ago three members of the honor council were designated on a mission to represent the apprentice body and failed to discharge their duty. This was brought to the attention of the honor council which immediately convened and after a searching inquiry demanded their resignations from the council which were accordingly given. This incident is conspicuous because of the prominence of the men involved.

Some months ago three apprentices outside of working hours committed a serious offense. These men were brought before the honor council and recommended to the supervisor of apprentices for dismissal from apprenticeship and employment; this was accordingly done. After some months, one of the men confessed to his error and asked to be taken back. This request was considered by the council, which recommended that the boy be reinstated on probation, and this was done.

The young man continued with his apprenticeship under these conditions and finished the course. Prior to his indiscretion he had won in athletics, due to his spirit and sportsmanship, the apprentice letter "A." This letter, which had been recalled on his dismissal, was not returned when he was taken back on probation. Upon completion of his course a mass meeting of the entire apprentice body was called for the purpose of distributing letters and honors which had been earned by other apprentices in the recent contests. At this meeting there were also present a number of the yard officials. At the last, after the honors to the other apprentices had been

awarded, this young man was called to the front and his letter returned to him amid the applause of all present. He is still a faithful employee of the company, but he has not forgotten the lesson which was administered by the honor council while he was an apprentice.

Results

We can hardly over-rate the importance to the youth of the formation of right habits during his apprenticeship. The governing body and the honor council exert a powerful control over their associates in this respect. With apprentice groups who are keen and alive to their advantages; who are deeply interested in their trades; who have agreeable associates with like ambitions and high ideals of character and deportment; who have inspiring traditions of the past, and who realize that they must uphold and contribute to these traditions, it may reasonably be assumed that a good proportion of such men will be in sympathy with and help to promote all endeavors to increase efficiency and production.

Such ideals may, to a large extent, be implanted in the minds of a goodly number of the boys by the supervisor of apprentices, the instructors in the school and those who teach them in the shops. This influence is constantly exerted by the honor council or governing body. In the matter of discipline it is usually more severe in their requirements than the instructors. If bad habits are corrected in early life a useful man will develop who will be a credit to the community.

Annually, after the football season has closed, the company gives a banquet to the entire body of apprentices. These functions are held in the high school building. The city school officials, representatives of the press, a few prominent guests, and the officials, superintendents and foremen of the company are invited. The occasion is enlivened with music by the apprentice band, snappy speeches, to which the boys also contribute, and apprentice yells occasionally sandwiched in. The enthusiasm and spirit which prevail on these occasions continue long thereafter.

Roller bearing equipment for the C. M. & St. P.

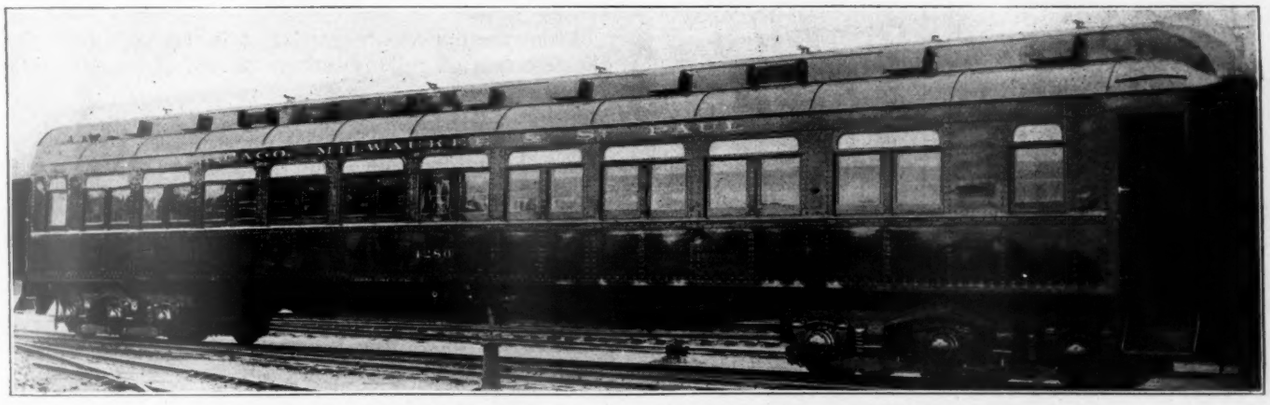
Tests extending over two-year period demonstrates practicability—127 passenger cars equipped

As a result of tests conducted over a period of two years, demonstrating the practicability of roller bearings of several types and their advantages over plain bearings, the Chicago, Milwaukee & St. Paul recently decided to make an extensive installation of roller bearing-equipped passenger trains. Sixty-four new Pullman cars and 63 cars of St. Paul ownership were accordingly ordered fitted with roller bearings. While both Hyatt and S.K.F. bearings were tested with satisfactory results, the order for roller bearings for this equipment was placed with the Timken Roller Bearing Company, Canton, Ohio.

The experience of the St. Paul in testing roller bearings as compared with plain bearings was outlined recently by L. K. Sillcox, general superintendent of motive power in a paper read at the Chicago, Milwaukee & St. Paul annual car department staff meeting, held at Milwaukee, Wis., September 20, 21, and 22. An abstract of this paper appears below:

Mr. Sillcox's paper

Among the advantages which test experience on the Chicago, Milwaukee and St. Paul indicates may be expected of roller bearings as applied to passenger car equipment are reduced train resistance, practical elimination of rough handling in starting long trains, easier riding equipment, less chance of hot boxes, ample warning when defects develop, fewer slid flat wheels and a saving in lubricants. Another practical consideration is the possible elimination of different engine ratings for summer and winter where air temperatures have a wide variation.



C. M. & St. P. all-steel passenger coach No. 4280 equipped with roller bearings

While roller bearings have been discussed and considered for steam railway service during a period of

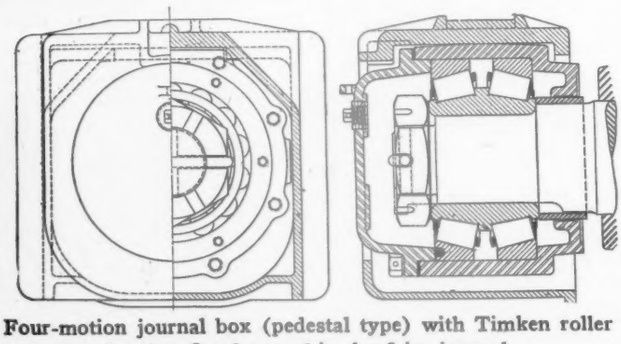
almost 25 years, the missing quality has always been that of durability, and designers of such bearings in their efforts to produce something suitable apparently erred on the side of giving the mechanics of the subject too much attention. They seemed to be interested chiefly in obtaining large contact areas, and in their endeavor along these lines, unfortunately neglected many other essentials, which were necessary in the development of this heavy type of bearing.

Eventually, it was realized that it was not sufficient to state simply that a bearing dealt with so many pounds load at a certain speed. The fatigue resisting properties and ability of the bearing to absorb and direct elements of side thrust under very difficult conditions of load and speed, needed consideration as well. Where the loads were high, but the speed low, the problem could always be solved by means of a ball-type bearing; but such bearings would have to be of dimensions quite impracticable in many cases, and necessitated redesign of truck frames and associated parts in order to accommodate the new construction. This fact, together with the higher cost of the bearing itself, presented a problem which has until recently appeared insurmountable from a financial standpoint.

Roller bearing developed for standard truck design

For this reason months were spent on the Chicago, Milwaukee & St. Paul endeavoring to develop a roller bearing which would take our standard type truck construction. This was worked out by engineers of S.K.F. Industries, Inc., New York, the final result being an assembly as illustrated in the photograph and one of the drawings. It will be quickly recognized that a standard cast steel truck frame was used and the only change made was that of applying straight equalizers rather than the curved ones, as in the past.

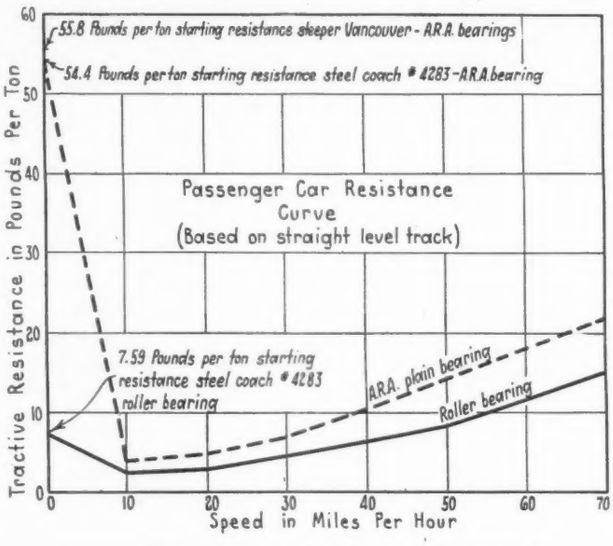
It will be observed that in the design of the cast steel pedestals, the pedestal legs were shortened to accommodate the new type box, and made considerably stiffer to eliminate the necessity of using a tie bar between them, sufficient rigidity being obtained to take care of the longitudinal thrust to which they are subjected. The method of applying the journal load through the straight equalizer and below the center line on the journal box, serves to keep the box in suitable alignment through the pendulum action of the load. The journal box is of cast steel, and since it is subjected both to tensile and torsional stresses, it has its heavy section around the load-carrying surface at the top, and stiffening ribs both at the top and around the bottom stirrup which carries the equalizer. The outer race of the bearing is in contact with the crown of the box through an arc of 150 deg. A forged shoe is dropped in the bottom of the stirrup to center the equalizer properly and secure it against motion longitudinally. A safety hanger is provided between the equalizer bar and the pedestal. Manganese steel pedestal liners are employed.



Four-motion journal box (pedestal type) with Timken roller bearing fitted to a 5-in. by 9-in. journal

A design using bearings made by the Hyatt Roller Bearing Company, Newark, N. J., also illustrated in a drawing, has been developed and is operating under Coach 4283. The third drawing shows the design of a four-motion journal box with Timken roller bearings, developed and adopted for use on the equipment just ordered.

From these drawings, a good idea may be gained of the types of bearings discussed. Both the S.K.F. and Timken bearings employ rollers having a maximum pressure on the outside, thus forcing the oil toward the center and assisting constant lubrication. The Hyatt bearing has a plain roller, non-opposing and thus necessitates an end thrust washer to take the lateral strain.


55.8 Pounds per ton starting resistance sleeper Vancouver - A.R.A. bearings
54.4 Pounds per ton starting resistance steel coach # 4283 - A.R.A. bearing
Passenger Car Resistance Curve
(Based on straight level track)
7.59 Pounds per ton starting resistance steel coach # 4283 roller bearing
A.R.A. plain bearing
Roller bearing
Tractive Resistance in Pounds Per Ton
Speed in Miles Per Hour
0
10
20
30
40
50
60
70

Comparative resistance of plain and roller bearings

Vital factors in roller bearing design for railroad equipment

From the experience gained, it is our judgment that the selection of roller bearings should be made on the following basis:

1—Minimum friction.
2—Ability to deal with both thrust and radial loads.
3—Ability to deal with thrust load in one direction.
4—Ability to operate successfully for at least 1,000 miles after becoming initially defective, in order to allow a car to be brought to a terminal.
5—Ability to operate a minimum of 600,000 miles without failure of parts, wreck damage excepted.
6—The unit should be self-contained, with minimum number of loose parts, and should be non-adjustable.
7—The unit should be capable of quick inspection.
8—The unit should have the feature of self-alignment.

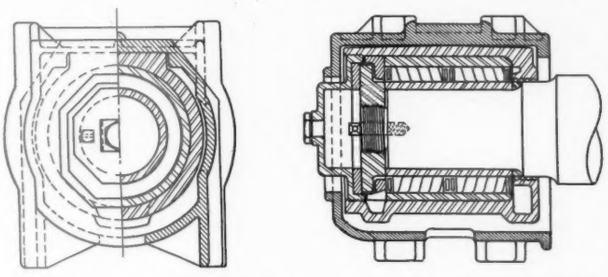
The ideal lubrication for an anti-friction bearing is a constantly circulating oil in an ample, but not too ample, volume and with only slight pressure.

Five main difficulties lie in the way of oil lubrication. Heat is generated by the churning of the oil at speeds as low as 300-400 r.p.m. (32-43 m.p.h.) unless an overflow is provided to maintain a proper level. This churning and heating increases proportionately with the depth of the oil and the rate of speed. Oil, being a liquid, is hard to retain in a housing. This is especially true because under the churning action of the moving

rollers the oil is vaporized and is dissipated to a certain degree. Owing to vaporization and other factors, oil requires renewal every six months or more. When axles are not revolving, force of gravity draws the oil to the bottom of the housing, leaving the bearing dry and exposed to rust; filling housings full enough to cover the rollers at all times results in the above-mentioned churning and heating.

Oil is more expensive than grease

However proper oil lubrication might be, it is almost impossible to attain minimum rates of expense under the average service conditions. As a result, grease is generally recommended for use where possible, at all speeds and temperatures and for all sizes of bearings. This does not mean that on some applications oil will not give satisfactory service, but that a proper quality and grade of grease on these applications should give equal, if not better, service with less trouble.



Hyatt roller bearing applied to a 5-in. by 9-in. car journal

This recommendation is based on the following points:

1—Grease of the proper consistency does not work out of the housing.
2—Enclosure design is simplified.
3—Grease applied with a modern type of gun is kept perfectly clean.
4—Grease does not need as frequent renewals.
5—Grease does not sink to the bottom of the closure when the bearing is idle.
6—Suitable greases should be easy to obtain.
7—Since grease tends to fill the space between shaft and housing, it assists materially in keeping out dirt.
8—Under the high speeds the rise in bearing temperature is less than with oil.

The essential properties of a suitable roller bearing grease are: (a) Consistency a little stiffer than vaseline (this is important, as a grease of this consistency is stiff enough not to churn at high speeds, yet soft enough not to dry); (b) no abrasive or body-giving matter, such as talc, graphite or pumice; (c) mineral base—not vegetable or animal.

For a range in speeds of 300 to 840 r.p.m. (32-90 m.p.h.) a grease renewal once a year is said to be ample. Under any conditions the most frequent renewal is every six months.

At the time of renewal the housing should be filled up until some of the old grease works out which can be wiped off. This is also a good time to note the quality of the grease last used and to see whether it has hardened. The tendency of grease to dry out is what really determines the frequency of lubrication.

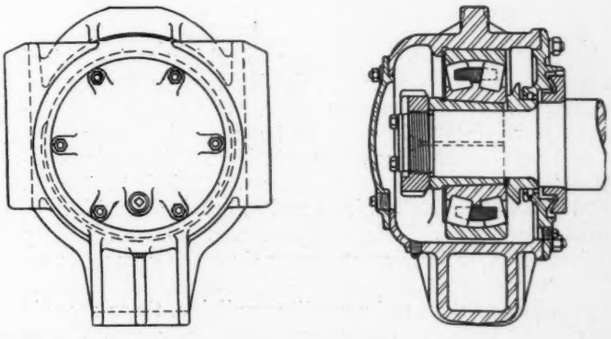
Train resistances compared

The best information which we have covering a comparison of resistances of cars equipped both with roller and plain bearings is shown in one of the charts. Our tests indicate that with steel sleepers the starting resistance may be as high as 55.8 lb. per ton; for steel coaches 54.4 lb. per ton; while under the same conditions, at the same time, resistance for steel coaches fitted with roller bearings was 7.59 lb. per ton. Under these circumstances it is possible to require in starting the Pioneer Limited, 15 cars, an effort from the locomotive of 67,200 lb. for equipment as fitted with plain bearings, as against 9,120 lb. required under these circumstances for equipment fitted with roller bearings—or in the ratio of approximately 7 to 1.

From available information, it is clear that the greater the weight per coach, the lower will be the running resistance per ton and, consequently, the greater the proportional advantage of anti-friction bearings. It also seems clear that the lower the speed, the greater the advantage to be obtained with roller bearings. The chart referred to seems to bear out this point. Drifting results obtained with plain and roller bearings are illustrated in a second chart.

Granting the reduction in starting resistance that any good anti-friction bearing will make possible, the question then becomes, in my opinion, one of life and cost. The utilization of the reduction in starting effort ought to bring about an entire change in motive power economics, but this will be a slow development with a good deal of resistance to be overcome. Those who have used roller bearings most extensively have been so satisfied with the practical results that they have thus far not been disposed to attempt to compare train resistance data through such elaborate tests as would be necessary. Therefore, they have only sought to confirm the known starting economy of roller bearings.

One of the principal difficulties encountered in attempting to evaluate the decrease in train resistance resulting from the use of roller bearings, is the lack of a definite standard for comparison in the form of data representative of standard friction bearing equipment. There is no question but that the variation in the friction of the plain journal bearing is an important factor



Roller bearing car journal design using S. K. F. bearings on 5-in. by 9-in. journal

and tests have been made to show the effect of journal temperature on train resistance. Whatever figures are available make it apparent that the actual train resistance of plain bearing equipment is very indefinite except in terms of general averages interpreted as representative of normal conditions. On the other hand, our experience with anti-friction bearings has shown that the friction of the bearing is constant over a wide range of speed and temperature conditions.

The inherent characteristics of the two types of bearings justify certain inferences. It is known that the efficiency of the plain bearing is determined by the factors that control the establishment of the oil film. These include both temperature and speed, which are

obviously variable in train operation, and also unit pressures which will vary with the type of equipment. The resistance of the roller bearing is practically independent of temperature and speed through such range as is experienced in train operation. An analysis of exhaustive tests of plain bearings which are comparable with those employed on car journals, indicates that only under most favorable conditions will the friction in a standard plain bearing compare favorably with that uniformly experienced with the roller journal bearing. Practical limitations preclude the normal operation of plain bearings under those favorable conditions, since the low viscosity of oil required does not provide a sufficient margin against sudden incidental effects, which would lead to a further decrease in viscosity.

Brake action on roller bearing car studied

The effect of roller bearings on brake action was studied recently; two coaches as nearly identical as possible in weight, brake equipment and truck construction, except that one had roller and the other plain brass bearings, were tested at Western Avenue, Chicago. Eight tests in all were made, the cars being stopped from various speeds with several different service and emergency brake applications.

It was observed that the wheels on the coach with roller bearings did not slide at any stop, while the rear wheels of the trucks on the coach with brass bearings slid at every stop made with an emergency application, the cause of the rear wheels sliding being due to the transfer of weight during the quick stop. This transfer of weight did not seem to affect the coach with roller bearings. The coach with the roller bearings ran a slightly greater distance, while subjected to the same applied brake force, than the other car, but the difference was so small as to have no noticeable effect in controling the train.

In connection with roller bearing applications, the importance of providing suitable hand brakes, buffers and draft gears (no preliminary spring action being required as at present to aid in starting trains), must not be overlooked. The advantages to be gained from drifting roller bearing-equipped trains are readily apparent and should be studied in service with a view to relieving the engine and consequently the coal pile to the greatest possible extent.

Filing of drawings and drafting room correspondence

Multiplicity of handlers, shifting of employees and unusual storage hazards important factors

By Warren Ichler

ANY discussion of a matter so subject to individual preferences, space limitations, usages, hazards, etc., as is a system of storing mechanical department records, will have to be general in character, rather than specific recommendations. A slight consideration of the subject will show why this is necessary. Records are valuable in direct ratio to their availability to *all* interested parties—in many respects the availability is an even more important factor than the completeness of the record.

It is obvious that, to be readily available, these records —historical data, if one gives them their real title— will have to be kept in such locations and in such manner as to be independent as far as possible of such disturbing factors as a multiplicity of handlers, a shifting personnel and extraordinary storage hazards. With these major requirements in mind, consideration of specific systems and their peculiarities can be attempted.

The filing of mechanical drawings presents some unique problems in record-keeping, in that it is governed more largely by bulk than is the keeping of correspondence or statistics which do not involve drawings or other large sheets of paper.

The two primary subdivisions of drawing lists

Nowadays practically every railroad mechanical drafting office subdivides its lists of drawings primarily by sizes and secondarily by subject matter, or else reverses the order of importance of these two subdivisions while retaining the same general scheme.

In order to adapt the sizes of blue-prints to correspondence, the dimensions of drawings most in vogue at present are the dimensions of ordinary bond paper (8½ in. by 11 in. or 8½ in. by 12 in. letter size), or multiples of these sizes. Thus a list of drawing sizes could be prepared and standardized in practice as follows:

No. 1 size—8½ in. by 12 in.
No. 2 size—12 in. by 17 in.
No. 3 size—17 in. by 24 in.
No. 4 size—17 in. by 36 in.
No. 5 size—17 in. by 48 in.
No. 6 size—24 in. by 51 in.
No. 7 size—34 in. by 60 in.

Larger sizes, if desirable, could be further multiples of the same basic figures. Prints of the sizes given will, of course, fold readily to letter-head size and pack easily into the large envelopes provided for unfolded correspondence files. Occasionally for convenience, fold lines are indicated on the margins of drawings and prints as in the accompanying illustration.

This index of sizes furnishes a valuable reference guide and in some cases the only reference guide to the location of the drawing in the files. That is, in a list of drawings not exceeding, say 2,000 sheets, it is possible to place all of the No. 1 size in one drawer or other compartment; all of the No. 2 size in another compartment, and so on. Under this system the individual drawings could be catalogued without regard to subject primarily, and merely numbered serially thus: 1-211; 2-212, etc., in which the first number indicates the size of the drawing and the second number its serial position in

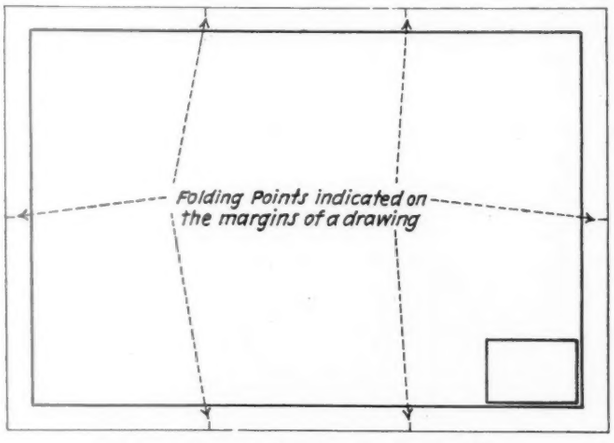
the catalogue. Obviously, this system is applicable to small, fixed files only, but with many of the smaller carriers where files of builders' prints of one or two classes of engines and cars are maintained, this method of filing would be sufficiently flexible since a recollection or preknowledge of the probable size of the drawing would probably locate its compartment position without reference to the catalogue cross index of subject matter. Of course for completeness the ledger or catalogue of the entire file would contain the subject of the drawing but the subject would be subordinated to the size and serial numbers.

Thus, a typical entry in the ledger would read

Drawing No.	Title or subject
1-211	Reverse link—engines 1-21
7-212	Boiler—engines 32-33
3-213	Erecting valve gear—engines 1-21

and it is evident that from the standpoint of bulk alone, this system would be ideal since it can be contained in a maximum of seven or eight compartments and would probably be even more severely condensed by combining in one larger drawer several of the smaller sizes separated only by thin partition strips.

But as railroads expand and new developments occur,



One method of folding large drawings

records pile up and the simplicity and compactness of the storage system just described have to be sacrificed to secure better availability of the records. It is not uncommon on a Class I railroad operating some 800 locomotives and from 30,000 to 40,000 freight cars to find files of mechanical drawings totaling 25,000 to 40,000 separate sheets all of which are live drawings; that is, in more or less active demand.

In such a case it is imperative to have at least two primary subdivisions of drawings and this is most easily effected by a combination of the sizing system just described and of subject matter of drawings. The storage problem now has injected into it the element of space limitations and since it is physically impossible to provide room for each minor subdivision of the various parts of locomotives and cars we have to effect a grouping into general classes of the various related parts of locomotives and cars in order to avoid an intolerable unwieldiness in filing cabinets.

The general subdivision classifications

At this point enters the personal element. How many general subject classifications on a locomotive shall we have? Is it advisable to group with boiler drawings the boiler appurtenances such as injectors, check valves, grates, and ash-pans? Such questions could be multiplied endlessly and any reasonable number of part classifications adopted; but any such system is bound to be purely arbitrary in certain details at least, and not universally applicable.

It is suggested that as a basis for this classification and cataloguing of part drawings, the Locomotive Dictionary's chapter headings offer some valuable suggestions. It is not recommended here that the various groups should be so severely condensed into great group families, as is done in that volume; but at least we have a guide toward a more or less common practice in relegating frames and spring-rigging; cabs and cab mountings; valves and valve-gears, etc., to common classes or groupings.

Now as to the distinguishing marks for these groups of drawings. For the sake of variety and for the avoidance of title confusion, it would seem best to turn to the alphabet for markings for the various classes. Under this combination of number-letter notation of headings, 26 groupings are provided for, and in most cases this should be ample for all preferences and needs of the drafting room.

Of course we have to retain both in fact and in record the separation and notation by size and serial number so that our titles and numbers as entered in the catalogue take on some such appearance as this:

Drawing No.	Title or subject
1-A-211	Reverse link—Engines 1-21
7-E-212	Boiler—Engines—32-33
3-A-213	Erecting valve gear—Engines 1-21

in which *A* denotes the classification assigned to valve gear parts; and *E* the identification symbol of boiler drawings. Then by marking file compartments 1-A; 3-B, etc., it is evident that this comparatively simple system will obviate a lot of tedious searching when once the classification-letter significance is understood and remembered by its users.

A variation of the above indexing method can be applied where not more than 26 classes of engines or cars are to be covered by the system. In that case the part classification is discarded and the letters or symbols each bear reference to a certain class or group of locomotives. This third method of filing would remove the factor of arbitrary classification of units or parts from the filing scheme but would retain all the bulkiness of the former system, since as many filing compartments as the number of drawing sizes would have to be provided for each class of locomotives and each class of cars.

Then, too, this third system is not truly definitive since a 3-a drawing may as easily refer to a car draft gear as to a locomotive valve gear part except for the following serial number. Since the serial number of a drawing is not really an identification tag, except to a very limited extent, there would have to be a complete separation of car and locomotive drawings for rapid reference work unless the filing was under constant control of one person, who could manage a separation of the car and locomotive drawings in each compartment by means of cardboard separators or other devices.

A rather effective combination of the two systems just outlined is that which confines locomotive drawing classifications to the letters *A* to *L*, say, and frees the remaining letters *M* to *X* for use as designators of drawings covering freight and passenger cars or even cars and shop machinery and tools. Of course this again brings to the fore the matter of arbitrary classification of unit parts; hence making a personal rather than an impersonal system, but it is fairly moderate in its space demands and reasonably simple in its handling.

Along with the basic rules governing the initiating of any system for reference work, there must be considered the special variations covering those things in process of

development or retirement; that is, in a transition stage. For example, new and heavier frames are being applied to a certain class of locomotives; but the retirement of the old frames is being done so slowly that many parts related to the old frames have to be supplied until the betterment is completed in its entirety. It will be seen that this will involve a duplication of many drawings except in the case of the very simplest changes and since it is obviously impossible to provide individual filing space for all of the records of even one project of major importance, they will have to be filed in the proper existing spaces and receive some distinguishing mark or notation that will effectively protect the user from error.

This is most easily done, in the majority of cases, by suffixing a mark or letter or number to the serial number of the drawing to call attention to the date of issue or the precedence of the drawing over similar drawings of the same subject. A typical index page would show such entries thus:

Drawing No.	Subject or title
3-A 211	Frame—Engines 1-21—original frame
3-A 211-A	Frame—Engines 1-21—redesigned (heavy type).

Until the completion of the betterment constant vigilance will be required to keep only the drawings applicable to the individual cases in circulation. Upon completion of the project the original drawings can be stamped "Obsolete" and transferred to that file, if one is maintained, or destroyed in the discretion of the proper officer.

Filing cabinets

In all the foregoing paragraphs, nothing has been said about filing cabinets,—in fact very little can be said except that they deserve and should get the same consideration extended to the records which they protect.

In other words, they should be as dust-proof as possible, should be easily cleaned, easy of access and located in good natural light rather than placed in some location selected mainly on the basis of its uselessness for any other purpose. All that has ever been said about the moral effect of well-kept surroundings on office personnel and the psychological effect of office cleanliness and harmoniousness on visitors includes the filing cabinet as well as the other furnishings.

Filing of correspondence

The drafting room originates few letters but receives many and the incoming correspondence is based of course, on indices unknown to any but the sender. Since nearly all of this correspondence refers to existing or pending drawings which are classified according to an established system it would seem practicable to transfer the established file-numbers or designations to the correspondence.

In this way an additional classification scheme would be avoided and knowledge of the existing system would be spread to clerical forces as well as the drafting organization proper. For example, a letter is received from a division master mechanic outlining certain defects developing in an engine truck journal box and suggesting needed changes in design. In the filing system for drawings these truck journal boxes are, perhaps, listed under classification *F* and the drawing covering the particular box under investigation is numbered 2-F-4220; the letter and copy of the reply would then be filed in compartment 2-F of the letter file where the classification mark 2-F would be instantly suggestive of the subject and also the related drawings.

An exception to this scheme has to be made in the filing of requests for blue prints in which several prints are mentioned in one letter. With these letters and replies the separation has to be effected by calendar months without other cross-referencing or indexing.

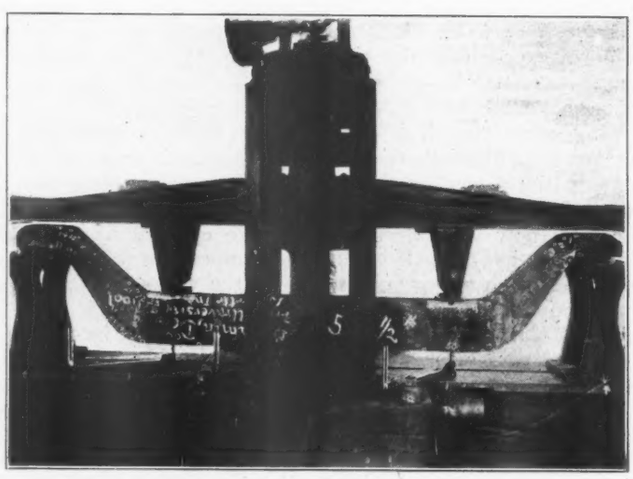
This scheme of filing correspondence is just as applicable to a detached drafting room at an outlying point as to a central organization at the general mechanical offices but the filing of drawings at division points, usually has to be greatly simplified to be readily workable by many clerks or mechanics not directly interested in the filing system.

While the storage system outlined below has many apparent disadvantages it has the great virtue of being obvious even to the poorest intelligence on a very casual inspection and is recommended on that account.

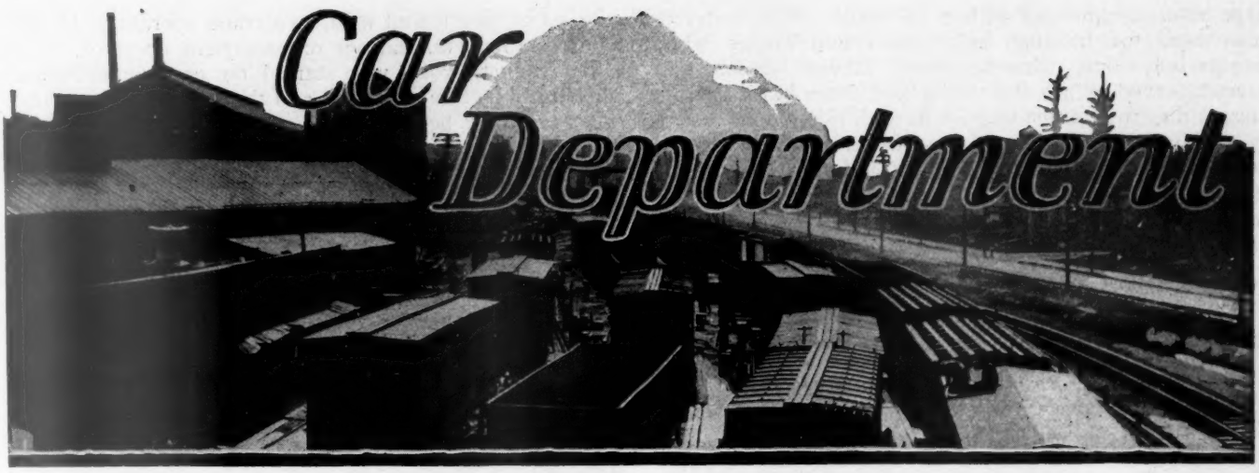
Briefly, it involves a primary separation of blue prints by locomotive classes or car classes and a secondary separation by sizes. Thus, one horizontal row of filing compartments or drawers would be devoted to engines 100-200 for example; while the next horizontal row would be given over to drawings covering engines 200-300, etc. The vertical rows would range progressively from drawing size No. 1 to the largest size. With this system a search for a drawing by a person entirely unfamiliar with the system would be localized instantly to the locomotive group involved and the chance of error would be greatly minimized, depending on the range of drawing sizes.

This method of filing is not so space-consuming as might be supposed; because in outlying districts motive power classes are apt to be restricted to the seven or eight groups of engines best adapted to the district and even where a greater diversification of locomotive types has to be dealt with, this hindrance is somewhat compensated by the fact that the individual compartments for the drawings can be greatly reduced in size from what they would have to be in a central office.

Nearly every suggestion made in this article is based on practices which emphasize simplicity above all other features. More elaborate methods and systems are possible. but since even the minor routine matters of transportation have to be covered by correspondence, drawings, maps, plans, etc., rather than verbally as in a centralized establishment; it has been judged best to use simplicity as a keynote rather than to employ a confusing multiplicity of suggestions.



A car truck equalizer is shown mounted in a 200,000-lb. Riehle testing machine at Purdue University—The load is applied at points where the coil springs of the truck bear on the equalizer

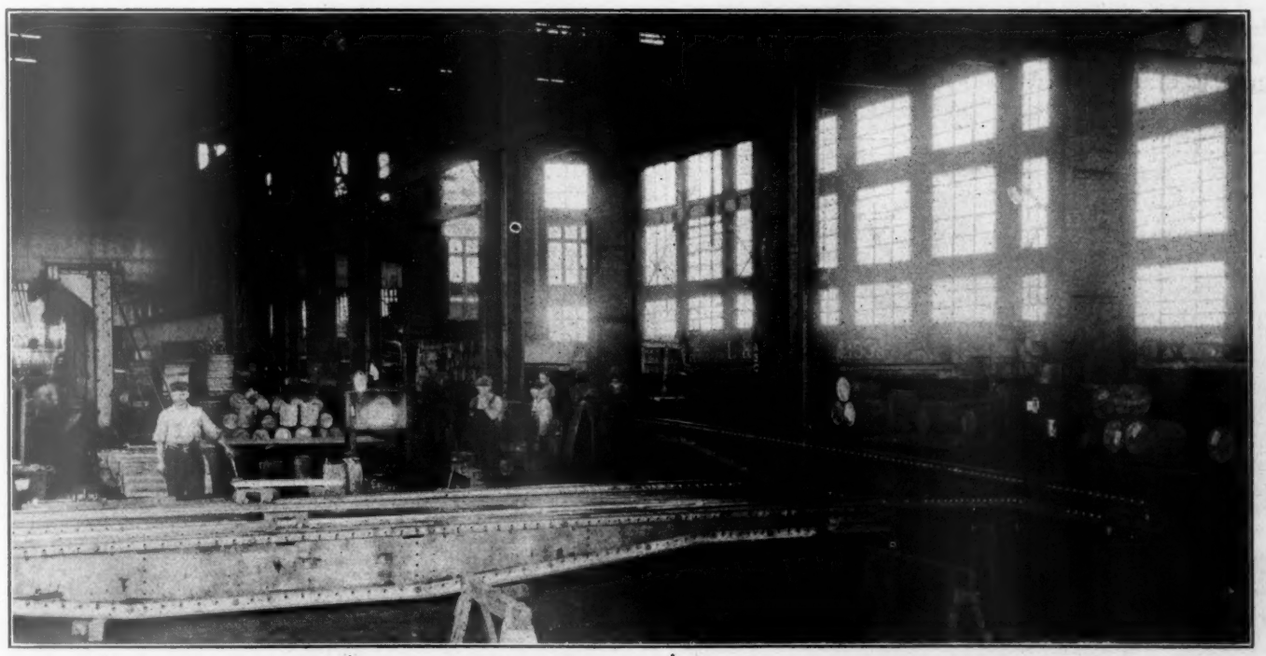


The fabrication of steel car parts

Description of equipment and some of the methods used at the L. & N. shops, South Louisville, Ky.

THE repair work on steel car equipment, both passenger and freight, of the Louisville & Nashville, is performed at the main shops, South Louisville, Ky. Although built a number of years ago, this shop has been kept up-to-date in machinery and equipment for the expeditious handling of its work.

The machinery section of the steel car shop is 88 ft. wide by 300 ft. long divided into 15 bays. It is equipped with 2 traveling cranes operating on runways the entire length of the machine section, and extending 200 ft. into the material yards, facilitating the transportation of materials to and from the building. The outside runway extends over yard tracks so that new material can be lifted direct from the car, and carried into the building, eliminating the necessity of excessive handling. When construction work is in progress one of the above cranes is used exclusively in the frame riveting position.

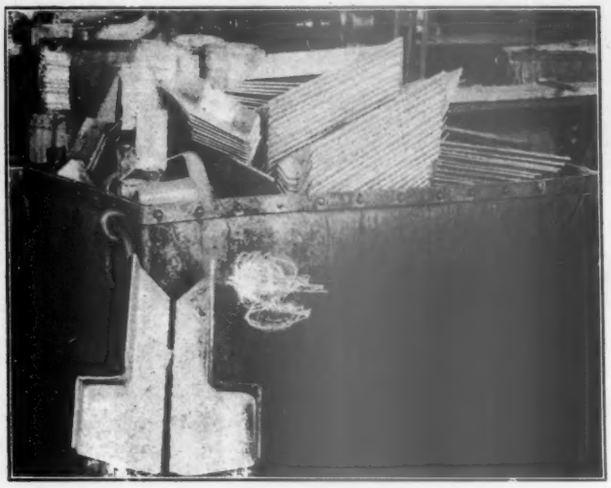


A mono-rail and chain hoist supports the web and angles while being riveted

Numerous jib cranes are located as needed for handling material at the machines.

The machine equipment consists of one triple-pressure 1000-ton Woods hydraulic press, one set of 12-ft. bending rolls, one set of 10-ft. straightening rolls, one No. 9 Ajax bulldozing machine, one Hilles & Jones No. 5 gate shear, one Long & Allstatter No. 2 vertical shear with 25-in throat, one No. 2 Long & Allstatter horizontal punch, one 50-ton, 24-in. Chambersburg hinged

type riveter, equipped with a jib crane (this riveter is also used for bending light plates and angles when necessary), one Chambersburg 50-ton 48-in. gap riveter served by a 5-ton trolley and chain block operating on a runway extending 70 ft. each side of the riveter to facilitate the riveting of long material. The shop is further served by one No. 2 Hilles & Jones rapid action punch with 20-in. throat and one 15 hp. motor-driven angle shear, one high speed radial drill equipped with jib hoist, two straightening presses, two bulldozers, and



Corner post braces formed two at a time and cut apart with the oxy-acetylene torch

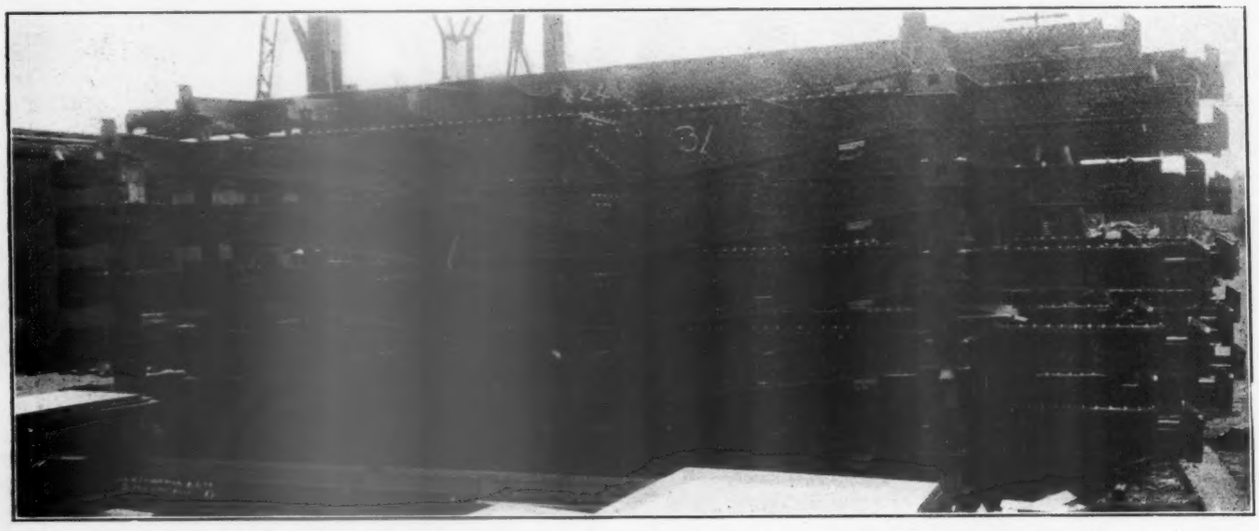
one portable pneumatic riveter. Of small machines, the list is as follows: two drill presses, one rotary shear, one 42 in. metal band-saw, one 24-in. back geared shaper, and one draft gear riveter. Adequate furnace capacity is available for changing and straightening. Layout consists of two layout men, two crane operators, 11 car men, nine helpers, and one oxy-acetylene operator.

In August, work was started on new underframes for hopper bottom gondolas, and the method of handling this work may be of interest. The material is ordered

Structural steel shapes and pressings ready for assembly

for lots of 40 cars each and comes into the shop at the end near the layout table. This material includes steel plates for the center sill webs, top and bottom cover plates, crossbearers, built-up body bolsters and stiffener angles. The material is laid out, sheared, punched and anything requiring heavy flanging sent to the flange furnace and 1000-ton press. This press is used for large shapes and the buildozer for smaller shapes.

The webs and stiffener angles are suspended by chain falls from a monorail trolley as shown in one of the illustrations, and riveted in the 48-in. gap riveter Material for the cross beams and parts of the body bolsters



Pile of completed steel underframes at the South Louisville shops of the Louisville & Nashville

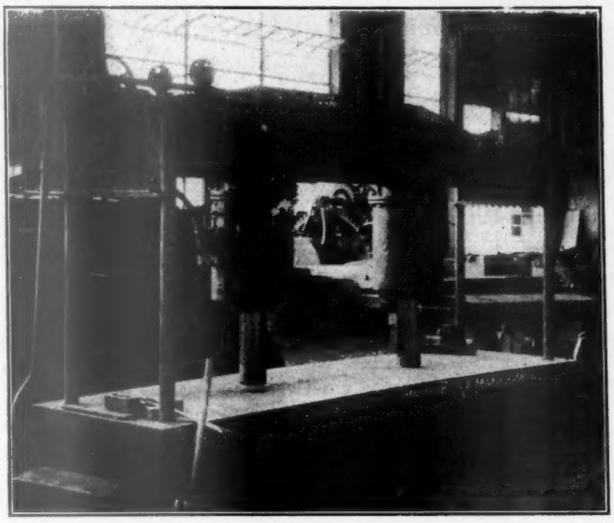
tables, straightening tables and face plates are also provided.

In an average month 794,785 lb. of fabricated material are turned out of the South Louisville steel car shop with a total force of 26 men, excluding those employed on erection work. The material worked up consists of: angles, 12,192 lb., channels 14,120 lb., Z-bars 104 lb., and sheet steel 768,369 lb. The working force are punched and made ready for assembly on the main frame.

The work of erection is then carried on with two frames at a time, each worked on by a gang consisting of two car men, two helpers and one rivet heater. The underframes are set on tracks served by small electrical cranes with portable pneumatic riveting machines. One of the illustrations shows a number of these steel under-

frames completed and ready for application of the bodies.

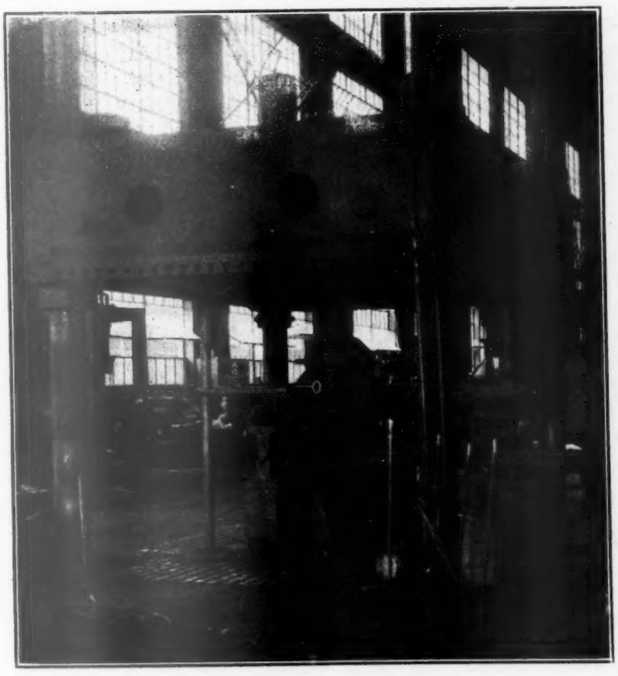
The two-cylinder pneumatic straightening machine illustrated has demonstrated its value in reclaiming steel plates and structural shapes, which, although bent and



Two-cylinder press used in straightening bent steel plates and shapes

out of shape, are not seriously corroded. These plates are heated in a nearby furnace, straightened quickly on the face plate while being held by the cylinder plungers and returned to service practically as good as new.

The limiting factor in a shop of this kind is usually



This Woods 1,000-ton press is kept busy on hot and cold press work

the hot press work and every effort is made in the South Louisville shops to schedule the operations so that the most effective service will be obtained from the 1000-ton press. In making the cornerpost braces shown in one of the illustrations, for example, two braces are made at one time under the hydraulic press and a straight cut along the center line with an oxy-acetylene cutting torch separates the two braces quickly and at a small expense. The saving in time at the press more than offsets the cost of labor and material for cutting.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Basis for computing depreciation of destroyed car

On February 18, 1924, the Chicago, Milwaukee, & St. Paul received at one of its repair shops Wabash car No. 65850 for repairs to defects due to its physical condition. Part of the defects placed the car under the provisions in the footnote to Rule 43. On investigation, the St. Paul was unable to advise the owner as to why, when and how the car failed in service, and, therefore, requested the owner for a valuation statement and a settlement under A.R.A. Rule 112. The owner notified the handling line that the car was built new during September, 1918 was five years and five months old and valued at $1,032.43. The repairing line called the owner's attention to the fact that the car received a new roof during September, 1918, and that its general appearance indicated it to be much older than designated by the owner. The owner admitted that the car had been retired and rebuilt in February, 1918, but contended that when cars were destroyed on foreign lines they should be paid for according to the dates on which the cars were reinstated after having been retired from capital accounts. The repairing line maintained that the settlement for the car should be made on depreciation based on the date the car was originally built new.

The Arbitration Committee rendered the following decision: "The contention of the Chicago, Milwaukee & St. Paul is sustained. Settlement for destruction of this car shall be made on the basis of depreciated reproduction value, depreciated from the date the car was originally built, in accordance with Rule 112.—*Case No. 1380, Chicago, Milwaukee & St. Paul vs. Wabash.*

Responsibility for the application of a wrong triple valve

Included in the repairs made by the Peoria & Pekin Union to Boston & Maine car No. 48904 was one K-1 triple valve applied to the car. Later, on December 24, 1923, the New York Central made repairs to the air brakes of the same B. & M. car and the billing repair card showed that one H-1 triple valve had been removed and a K-1 triple valve had been applied which was standard to the car. The New York Central's billing repair card was forwarded to the Boston & Maine, whereupon it attached the P. & P. U. billing repair card that was dated April 4, 1923, together with the billing repair card of the New York Central dated December 24, 1923, and requested that the P. & P. U. to issue a defect card covering one H-1 triple valve applied in place of the K-1 triple valve. The P. & P. U. stated that since an interval of

eight months and 20 days had elapsed between the time of the repairs made on its lines and the repairs made by the New York Central, and that since the car had moved over 22 different roads during that time. If wrong repairs existed at the time the car was repaired by the New York Central they were made by some line which neglected to furnish the B. & M. a repair card.

In rendering its decision, the Arbitration Committee stated that, "If the car was not on the home line at any time between the date of repairs made by the P. & P. U., and the date of repairs made by the New York Central, Rule 90 will properly apply, the Peoria & Pekin Union being responsible as set forth in Decisions 1027 and 1346. If the car was on the home line during the interval, the P. & P. U. is not responsible, in view of Decisions 1270 and 1285.—*Case No.* 1381, *Boston & Maine vs. Peoria & Pekin Union.*

Handling line fails to show how car was damaged

On November 26, 1923, the Norfolk & Western requested the Wabash for disposition under A.R.A. Rule 120 of its car No. 65685, but failed to show how the car was damaged. The Wabash granted the N. & W. authority to repair the car and at the same time requested the repairing line to advise the circumstances under which the damage occurred. The Norfolk & Western advised that when the car was offered to the Hocking Valley in interchange that road had refused to accept it on account of broken sills, but owing to the fact that the car was not in an accident or otherwise damaged under the provisions of Rule 32, it was not necessary to make out an accident report. A representative of the Wabash inspected the car and reported the damage indicated that it had been in an accident. Therefore, the Wabash contended that, since the handling line failed to furnish the circumstances under which the car was damaged when more than five longitudinal sills were broken, as per note under Rule 43, the handling line was responsible for the damage to the car.

The Arbitration Committee decided that "The handling line is responsible because of the failure to furnish a statement showing the circumstances under which the car was damaged, as per footnote to Rule 43. Decision No. 1302 is parallel."—*Case No.* 1382, *Wabash vs. Norfolk & Western.*

Joint evidence of wrong repairs is final

Detroit & Toledo Shore Line applied a new end running board to the "B" end of tank car C.E.R.X. No. 4166, for which it billed the Indian Refining Company in the amount of $6.91 which the owner approved and passed for payment in accordance with the requirements of A.R.A. Rule 91. The car, after being repaired, arrived at the owner's plant where, upon inspection, it was found that wrong repairs had been made to the running board which did not comply either with the owner's standard size running board for this car or, with United States Safety Appliance requirements. In accordance with A.R.A. Rule 13, a joint inspection was held and a joint evidence certificate executed. The wrong repairs in question were repaired by the owner, after which the owner presented a joint evidence certificate and D. & T. S. billing repair card covering the wrong repairs and requested the handling line to furnish a defect card for the cost of making the corrections. The handling line refused to issue the defect card, stating that its records showed that the repairs were made in accordance with the M. C. B. rules and also in accordance with United States Safety Appliance requirements.

The Arbitration Committee rendered the following decision: "Joint evidence is final as to the wrong repairs. The Detroit & Toledo Shore Line should issue its defect card accordingly."—*Case No.* 1375, *Indian Refining Company vs. Detroit & Toledo Shore Line.*

Again—Rule 32

On December 3, 1923, Atlanta, Birmingham & Atlantic car No. 5101 was broken in two in switching service on the Reading Company's lines. This car, together with some other cars, was dropped in on one switching track but after they were in position on this track they did not clear the track next to it. As a result, the cut of cars which contained A. B. & A. car No, 5101 was pushed up to the long string of cars on the track and a coupling was made without stopping. As a result, the flat car, No. 5101, broke in two. The owner contended that this was incorrect handling by the yard crew and that an ordinary stop and coupling should have been made when coupling to the second string of cars. The handling line contended that the car failed in regular switching service owing to broken and decayed sills and that the car was not subjected to any of the unfair conditions covered by Rule 32.

In rendering its decision, the Arbitration Committee stated that, "The car was not subjected to any of the unfair conditions of Rule 32. The car owner is responsible."—*Case No.* 1374, *Atlanta, Birmingham & Atlantic vs. Reading Company.*

Defect card destroyed in fire creates interesting case

On or about December 29, 1916, the Kansas City Southern rendered to the Gulf Coast Lines a bill for repairs to its freight cars. Nothing was heard of this bill until July 14, 1921, five years after it was rendered when the Gulf Coast Lines advised that the bills had been destroyed by fire and therefore, it would be necessary to have duplicate repair cards supporting the bills. All the bills were finally paid except one which contained a defect card covering repairs to C. R. L. car No. 3676 which had been damaged by fire. The Gulf Coast Lines insisted that the Kansas City Southern furnish it with a copy of the defect card, which it was unable to do for the reason that the original defect card had been attached to the destroyed bill. The Gulf Coast Lines advised that an investigation showed that the car had not been damaged on its line and that its defect card had never been issued to the Kansas City Southern. However, on January 25, 1924, a traveling accountant of the K. C. S. located the lost book of defect cards in which was a carbon copy showing that the Gulf Coast Lines had issued a defect card on the car in question. The Gulf Coast Lines denied that it had issued a defect card, stating that the card had been written but not issued and, therefore, as the car had not been damaged on its line it was the handling line's responsibility. To this the Kansas City Southern replied that if the defect card had not been issued, a carbon copy of it would not have been found and furthermore it could not have billed the Gulf Coast Lines without attaching a defect card to the bill.

In rendering its decision, the Arbitration Committee stated that, "The evidence shows that repairs to C. R. L. car No. 3676 were billed on the regular authority of a defect card. Rule 15 also applies. The charge in full, is sustained."—*Case No.* 1373, *Kansas City Southern vs. Gulf Coast Lines.*

Chief Interchange Inspectors' proceedings

Special attention given to the subjects of billing and progressive rebuilding of house cars

AT the twenty-fifth annual convention of the Chief Interchange Car Inspectors' and Car Foremen's Association of America, held at the Hotel Sherman, Chicago, September 21 to 23, a partial report of which appeared beginning on page 607 of the October *Railway Mechanical Engineer*, considerable attention was given as usual to the subject of billing. A paper on the preparation of A. R. A. billing repair cards and record of repairs simultaneously at the car was presented by C. C. Hennessey, head A. R. A. clerk of the Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind. The progressive rebuilding of house cars was described by C. M. Hitch, district master car builder of the Baltimore & Ohio at Cincinnati, Ohio. Abstracts of these two papers appear in this issue. The discussion of the A. R. A. rules will appear in a subsequent issue.

A. R. A. record and billing repair cards

By C. C. Hennessey

Head A. R. A. clerk, Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind.

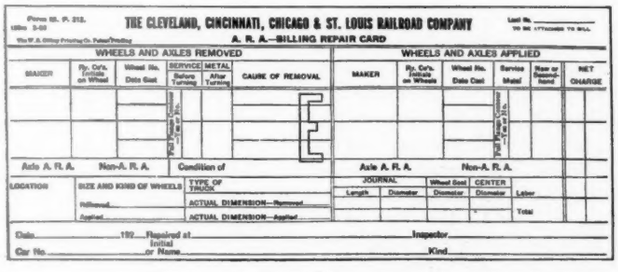
The practice of making in one operation at the car the original record of repairs and billing repair card as required by A.R.A. Rules 7 and 8, and the supplementary regulations to those rules has now been in successful operation at all repair points on the Big Four for one year.

This is a money saving method for authorizing, recording and checking repairs to railroad cars and billing for or reporting those repairs to the car owner as required by the A.R.A. rules.

In order that the thin sheet of paper which comprises this complete combination of the two cards or records may be written upon out of doors under all weather conditions, without handling the sheets and carbon paper on the repair tracks and to protect the cards from rain and soil while they are on the car during the time it is undergoing repairs, it is necessary that some practical means be provided that will accomplish these results without slowing up the supervision or outside forces in authorizing, recording and checking the repairs.

We have found that the best practical means so far developed for this purpose on the shop or repair tracks is the two leaf aluminum folder. We have in service a number of three leaf aluminum folders that will hold four of the large cards, but as two of these cards will take care of the work on the usual run of foreign cars, we are now using the two leaf folder which holds two of these large cards and in case of exceptionally heavy repairs where more than two cards are required for a car, we use an additional folder on that car. This reduces the cost of the folder as well as its weight.

Folded combination billing and record cards, with carbon paper in place for foreign cars and single record cards for home cars are inserted in the aluminum folders by a clerk in the car foreman's office, whose duty it is to keep a sufficient supply of aluminum folders with cards and carbon paper in place at a designated location, so that the prepared folders are always ready for use.


THE CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS RAILROAD COMPANY

A. R. A.—BILLING REPAIR CARD

WHEELS AND AXLES REMOVED

MAKER | Fly. Ctr's. Outside on Wheel | Wheel No. Date Cast | SERVICE Before Turning | METAL After Turning | CAUSE OF REMOVAL

WHEELS AND AXLES APPLIED

MAKER | Fly. Ctr's. Outside on Wheels | Wheel No. Date Cast | Service Metal | New or Second-hand | NET CHARGE

Axle A. R. A. | Non-A. R. A. | Condition of | Axle A. R. A. | Non-A. R. A.

LOCATION | SIZE AND KIND OF WHEELS | TYPE OF TRUCK | JOURNAL Length | Diameter | Wheel Seat Diameter | CENTER Diameter | Length | Labor

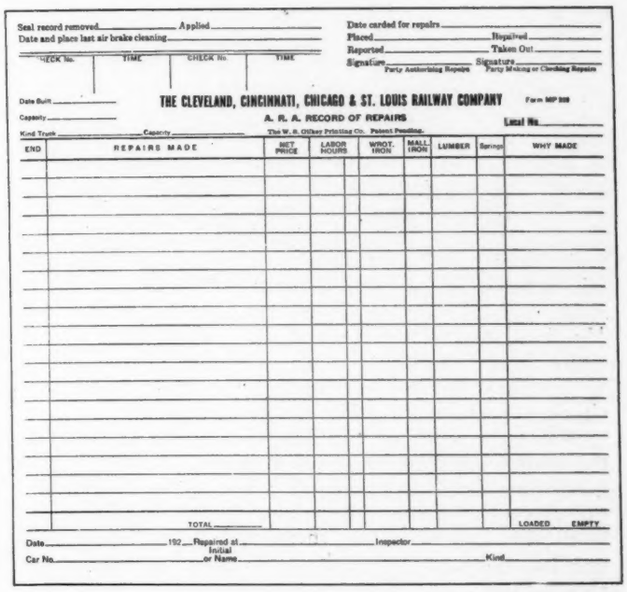
Followed | ACTUAL DIMENSION—Removed | Total

Applied | ACTUAL DIMENSION—Applied

Claim ..... 192.... Repaired at ..... Inspector .....

Car No. ..... Initial or Name ..... Kind .....

This form made in triplicate is carried in the aluminum box holder


Seal record removed ..... Applied .....

Date and place last air brake cleaning .....

Date carded for repairs .....

Placed ..... Repaired .....

Reported ..... Taken Out .....

Signature ..... Signature .....

CHECK No. | TIME | CHECK No. | TIME

Party Authorizing Repairs | Party Making or Checking Repairs

Date Built .....

Capacity .....

THE CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS RAILWAY COMPANY

A. R. A. RECORD OF REPAIRS

Local No. .....

Kind Truck ..... Capacity .....

The W. B. Ottley Printing Co. Patent Pending.

END | REPAIRS MADE | NET PRICE | LABOR HOURS | WROT. IRON | MALL. IRON | LUMBER | Springs | WHY MADE

TOTAL | LOADED | EMPTY

Date ..... 192.... Repaired at ..... Inspector .....

Car No. ..... Initial or Name ..... Kind .....

This form made in triplicate is carried in the aluminum folder

Folders distributed in flat closed position

In some folders we place two cards for a foreign car; in others, one card for a foreign car and one card for a home car, and in others two cards for a home car, all depending on the number of foreign and home cars and class of repairs usually made at each repair track. The folders so filled are kept in separate piles, each pile being suitably marked so that the cards can be distributed to the cars as needed. At points where no clerk is em-

ployed, this duty is usually performed by the car foreman.

As soon as bad order cars are placed on the repair tracks, one folder with cards and carbon inserted, is placed on one truck of each bad order car by a laborer, checker or other designated person. The folders are always placed in flat closed position on any convenient part of the truck, such as the end of the truck bolster, on the oil box or arch bar and on the same side of each bad order car on the track. The reason for always placing the folder in flat closed position on the truck is that the folder will then shed rain or water dripping from the car.

The person authorizing repairs inserts the car initials, number and kind of car and draws a line through the word "Loaded" where the car is empty, or draws a line through the word "Empty" where the car is loaded. He then writes each item of repairs to be made in the "Repairs Made" column, and a full description of the broken, defective or missing parts in the "Why Made" column, using judgment in regard to the number of vacant lines to be left under the first item before the second item of defects is entered in the "Repairs Made" column, in order to provide room for a full description by the party checking repairs, of the material applied, such as the make, type and size of coupler, whether new or second hand, etc., which information cannot be determined until the repairs are made. He then signs his name in the space provided, closes and places the folder back on the truck.

The car is now ready for the repairmen, who refer to the billing repair card in the aluminum folder and make only such repairs as are authorized.

Careful checks are made

After the repairs are made the person checking the repairs verifies the correctness of car number, initial, kind of car and whether loaded or empty; inserts the date built, capacity of car, kind and capacity of truck and makes sure that the forms carry a full description of all repairs made, the correct reason why the repairs were made and all information required by the A.R.A. rules. He then inserts the date of the repairs and signs his name in the space provided. The folder is now ready to be taken up and returned to the shop office by the checker, foreman or other designated party.

When the work of checking the repairs is completed, the folders are ready to be taken up and placed at a designated location in the shop office for prompt handling by the clerk or person who removes the completed cards from the folders, refills them and places them at the specified location, where they will again be readily available for use.

Any corrections necessary must be made by crossing out the item and writing in the corrections; no erasures can be made.

For repairs made on authority of defect card, the billing office writes the separate billing repair card required by the third paragraph of Rule 8.

The foreman of each repair track is held responsible for knowing that a folder is removed from each car leaving the repair tracks, including "set backs" and for placing the same folder on each "set back" car when it is again spotted on the repair track.

Each foreman or checker on the repair tracks is supplied with an aluminum box holder in which is carried blank wheel and axle repair cards with carbon paper between the fold of each card. This aluminum box holder is light and when opened forms a handy means upon which to write in all of the wheel and axle information required by the headings of the small A.R.A. wheel and axle billing repair card.

This wheel and axle form is filled out in detail at the car before the wheels removed are rolled or carted away to the wheel shop or loading platform. The person checking wheels is required to sign his full name in the space provided on each wheel and axle form and then to place the form, together with the bad order cards and all defect cards removed from the car, under the spring in the aluminum folder for that car, so that when the folder arrives at the shop office it will contain all repair cards, wheel and axle cards, defect and bad order cards for each car, unless two folders are used in the same car in which case all cards will be contained in the two folders.

Inspectors in transportation yard have holders

Each inspector in the transportation yard is furnished one of the aluminum box holders, in which is carried a supply of folded repair cards, with a sheet of carbon between the fold of each card, ready for use on foreign cars and a supply of single repair cards for use on home cars. These blank cards are placed in the top or upper compartment of the box, with the perforated edge of the folded cards at the top edge or side of the compartment. After opening the box which is hinged along its center either style of card is readily removed by placing the fore finger of the left hand in the hole in the bottom of the compartment, pushing all cards up from the bottom of the box so that they are easily pulled out with the thumb and fore finger of the right hand. The card while being written upon is held on the top section of the box under the thumb of the left hand which holds the box, the lower sections of the box forming a rest for the right hand while writing. After the repairs made to each car have been completed, one of these cards is filled out in detail at the car by the inspector or repairman who made or inspected the repairs and that party signs his own full name to each repair card, which is then deposited in the lower compartment of the box, wherein it is carried by the repairman until he returns to the shanty. The cards are removed from the lower section of the box, by inserting a pencil under all cards in the compartment and lifting them up so that they are all easily removed.

When repairs are made in transportation yards on authority of a defect card, the defect card is placed between the fold of the repair card where it remains until both the repair and the defect card arrive at the shop office.

The carbon paper is not removed from between the fold of the repair cards by the inspectors. All repair and defect cards are accumulated from all inspectors and forwarded at the close of each day to the shop office, where the clerk applies a local number to each repair card for each foreign car, after which the carbons are removed, the billing and record portions of each card separated and the billing repair cards forwarded daily to the billing office. The record of repairs for both foreign and home cars is filed at the shop office in a file case numerically according to the last two numerals in the car number. Repair cards from the repair tracks are handled in the same manner by the shop clerk.

Economies and advantages of this system

At line inspection or one man points, each inspector is furnished an aluminum box holder and at these points the work is handled in exactly the same manner as in the large transportation yards, except that the inspector applies a local number to each card, separates the billing and record portions, mails all billing repair cards to the billing office daily and mails his record cards for both foreign and home cars, daily to the division or district shop office where the records are filed.

To install this system at all repair points on the Big Four, 2,000 aluminum folders and 500 aluminum box holders were required. This system has several economies and advantages over the former practice of copying the billing repair card from a separate record.

It eliminates all clerks whose entire time is devoted to writing billing repair cards. This one item produced an annual payroll saving of $13,121.40 for the Big Four, which represents the annual salary of clerks taken off the payroll and their rates abolished.

The clerks, a portion of whose time was formerly devoted to writing billing repair cards, are now available for other work.

It eliminates all transcribing errors. It saves in correspondence and time in verifying car initials and numbers. The majority of the mistakes in car initials and numbers are made in transcribing from the original record to the billing repair card and when you eliminate these transcribing errors you save time and expense for the road making the repairs and also for the road that receives and checks your car repair bill.

A saving in stationary and filing space is effected by the elimination of the duplicate records.

It keeps the making of billing repair cards up to date at all times without additional clerical work on the supervision or outside forces.

It gives to the car owner first hand information regarding repairs made to his car and the reason for those repairs and prevents the clerk who writes billing repair cards from supplying any billing information that was not recorded at the car, which practice may be more or less prevalent where the billing repair card is copied from a separate record.

It makes available for constructive work, the time of the traveling A.R.A. inspector formerly spent in checking the record repair cards against the work cards. It enables the traveling inspector to obtain from the billing office information regarding the points most in need of his service, and provides able assistance to him in his efforts to educate the men on the A.R.A. rules and to locate promptly and instruct any one who is lax.

To insert carbon paper in 50 shop cards, 20 wheel cards and 50 train yard cards, and to insert and remove the 50 shop cards from the Aluminum folders, remove the carbon paper and separate the billing and record portions of the 120 forms requires approximately 30 minutes clerical labor. The time required for the distribution and collection of the aluminum folders to and from the cars will vary according to the conditions and general layout at each repair track. This clerical and outside work was absorbed at each repair point on the Big Four without additional cost to the railroad.

The aluminum folders and aluminum box holders are light and durable; they will not rust or corrode, and with ordinary handling their first cost is the last cost.

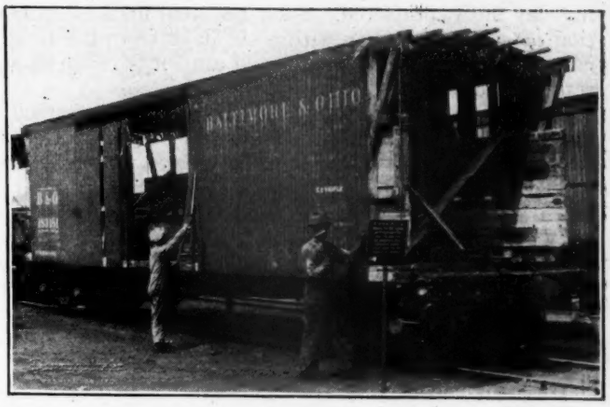
Progressive repairs to house cars

By C. M. Hitch

District master car builder, Baltimore & Ohio, Cincinnati, Ohio

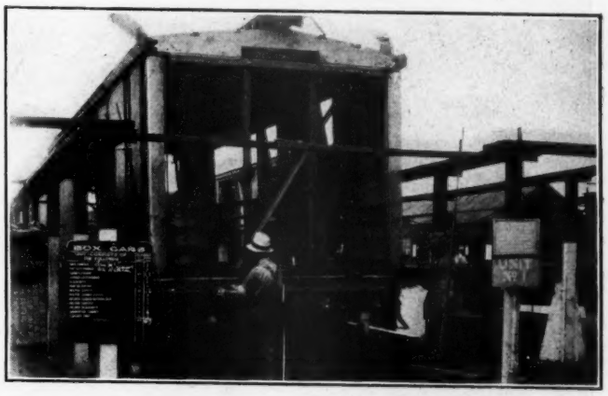
All cars requiring 60 man-hours or over are repaired on the progressive or spot system. We find that this system has improved our conditions materially and is the best way to repair or rebuild cars, being far superior to old methods.

The spot system provides that certain repairs to a car will be performed at designated spots on designated repair tracks in shops or on shop yards where heavy or rebuilding repairs are made. The work is handled in four different ways, as follows:



Station A—Stripping car for repairs by removing defective parts that are to be renewed or repaired

1—When repair tracks or shop tracks are sufficient in length to have 18 cars placed on each track, each track having switch connections on both ends so that cars can be started in on one end at the stripping spot and then



Station C—Repairing and fitting to place on house cars all framing above the underframe preparatory to the application of siding, and apply inside lining, floor and bevel strips

move from spot to spot until completed ready for service, the force on such track should be employed at six spots, each one sufficient in length to hold three cars, so that all cars can be moved up one spot at the close of each work-

Station E—Apply all safety appliances, hang and adjust doors, repair air brake and hand brake equipment, and apply the second coat of paint after the quitting time of the first shift

ing day until completed. Such a system insures completion of repairs to a car within six days from the time it enters the first spot to be stripped until it is repaired and returned to service.

2—When repair tracks or shop tracks are not sufficient in length to hold 18 cars then, 18 cars can be spotted on two adjacent tracks sufficient in length to have three spots on each track holding three cars each, or a total of 18 cars on two adjacent tracks. Cars placed for repairs on such tracks are first placed on the stripping spot, which is located on the entering end of the track, and the cars are moved at the close of each day from spot to spot over one track and back over the other to the end of the adjacent track. On such tracks one unit of the force is worked on two tracks in place of one track as above.

3—When repair tracks or shop tracks have a stub end on one end and switches connecting up the tracks on the opposite end, there should be a minimum of six tracks in such shop or shop yard, and the tracks should hold a minimum of three cars each. Such facilities provide for one unit of force to be worked on the spot system across the shop or shop yard.

If each one of the six tracks holds six cars on each track there are two spots on each track with three cars in each spot, where two units of force can be worked across the shops.

If each one of the six tracks holds nine cars on each track there are three spots with three cars in each spot, and three units of force can be worked across the shop.

Each unit of the force worked is assigned to certain tracks or track in a shop or shop yard.

At the first spot of each unit there is placed a bulletin board bearing the names of the unit foreman in charge and the assistant unit foreman, and showing the kind of workman assigned to the foreman.

Two columns are provided on this bulletin board, one to show the number of each kind of workmen composing the unit, and the other filled in with chalk immediately after starting to work each day by the unit foreman to show the number of such workmen reporting for work.

On the side at the corner of each car is placed a bulletin, painted black on one side and bright red on the opposite side. The black side shows the date the car was placed on the first spot for repairs, and the date it will be completely repaired and returned to service. The bright red side shows the words in white letters, "Material Wanted." This side of the bulletin is placed out when material cannot be obtained with which to repair cars and to show that the car is passing through the spot system needing material to repair it which could not be obtained.

Cars of the same kind and class when possible should be worked through the spots of each unit to insure maximum output. Repairing cars in this manner insures more satisfactory output and better work than if cars of a mixed class and kind are allowed to pass through the spots of each unit.

General view of shop tracks of the B. & O. at Washington, Ind., where unit and spot work is done

At shops where more than one kind of cars are being repaired the units repairing each kind of cars should be segregated as much as possible. If, for example, a shop is repairing both house cars and open top cars, one kind should be worked on one side of the shop and the other on the opposite side. This proves more satisfactory than to mix cars indiscriminately, as it separates the force better and segregates material used to repair the cars.

Advantages

This system of handling car repair work assures maximum production and minimum loss of material due to damage and waste. It further provides supervision that

is both pleasing to the workman and productive to the employer, because when advice is needed by the men it is promptly obtainable, making the conditions under which the employee is working satisfactory.

It provides maximum safety for the workman, because his work is done at a designated spot where the required facilities and material are placed, making it unnecessary for him to collect his own material and tools from scattered points in the plant, which may subject him to all the hazards that exist on the entire property.

It provides for maximum conservation of material because material suitable for work to be done at each spot is removed from the car and re-used at the spot where it is removed; or, when new material is needed, it is placed at the spot for use by designated material men.

Unit organization and spot system encourage the employer to provide steady employment for his employees for the reason that it makes production cheaper than can be obtained through any other means.

Question box report

The Question Box Committee considered and reported answers on 35 questions which had been submitted to it. In the discussion which followed the presentation of the report, the association voted to rule out questions 7, 11, 12 and 22 as being either not clear or irrelevant. The questions and answers are printed below serially as numbered by the committee, with these four omitted.

1—The A. R. A. Manual of Standard and Recommended Practice, March, 1925, pages B-45, 46, shows wheel cast iron, limit gage for remounting. This gage is not shown in A. R. A. rules and as it is used by foremen to determine whether or not cast iron wheels can be remounted or not, should it not be shown in A. R. A. rules with instructions regarding the proper method of using it?

A—See page 98, page 98-A, interpretation 3.

2—Stencilling of 40,000-lb. and 60,000-lb capacity cars which have non-A. R. A. axles has not been satisfactorily explained, as Rule 86 does not cover. Kindly explain the proper method of stencilling this class of equipment until expiration of time limit for non-A. R. A. axles.

A—See minutes meeting March 3, 1926. Supplement 2, Paragraph H.

3—How should depreciation be figured on an all steel car which has been rebuilt from a composite car, using the trucks and the steel center sills of the old car which have the A. R. A. required strength. In rebuilding, should depreciation be figured from the date the composite car was built, or the date the all steel car was built?

A—From the date originally built. See interpretation 3, Rule 112.

4—Road A passes Road B's bill for car repairs and takes certain exceptions, which are adjusted by Road B. Five months after receipt of the bill and 90 days after the bill was passed for payment, Road A finds that a duplicate charge existed in Road B's bill. Road A calls this to the attention of Road B and requests cancellation of one of the charges. Road B refuses, claiming that exception should have been taken within 60 days from the date the bill was passed. Is Road B correct?

A—Yes. See Rule 91, section C, Interpretation 5.

5—Road A receives a box car from Road B with doors bulged on account of the load shifting. The doors had originally been protected, but this protection was broken. The load was adjusted and new door protection applied and bill made against Road C, the originating carrier. Road C refused payment, claiming that proper protection had been applied by the shipper. Who should stand this expense?

A—Road B; delivering line responsible.

6—Road A receives box car from Road B loaded with cement in bags. The load is shifted and the doors bulged. Road A adjusts the load and applies door protection, billing the expense to Road C, the originating carrier. Road C refuses payment, claiming that cement is not a commodity requiring door protection and that no charge is in order. Who is right?

A—Road B. Delivering line responsible.

8—Do items 11 and 12 of Rule 111 cover all cases of cylinder gasket renewal, even though the repairing line claims that it was necessary to R. & R. cylinder?

A—Where the construction of the car necessitates cylinder removal to apply gasket, additional charges can be made.

9—If we remove a defective truck side from a foreign car and apply one of different make on account of which we have to change the opposite truck side to correspond, is the opposite good truck side second or scrap? It is not an A. R. A. standard. When we apply defect card to cover this change, we pay for labor and material and the owners invariably credit us with scrap on the good sides removed. Should we do likewise when removing the owner's standard?

A—The opposite truck side is second-hand. Apply defect card, labor and material to both wrong frames applied.

10—Explosive rules ask for the removal of dome cantion cards from all empty tanks. When this is done during night hours, are we not violating other Bureau of Explosive rules, which tell us to keep lights and fires away from all tank cars?

A—Use electric lanterns. See page 233, Bureau of Explosive pamphlet "J", also page 235. Never use lighted lanterns.

13—Regarding Supplement 2, note to Rule 101, on friction draft gears: How should credit be given for gear removed having friction casing and other parts defective, but not all parts of the gear defective?

A—Rule 101, effective January 1, 1926 explains. Arbitration case 1474.

14—Can rivets charge be made per Items 439 and 440 of Rule 107 on rivets used in the manufacture of new sill steps with center tread and new side and end ladders, which have handholds riveted to stiles.

A—Rule 101, Item 188-A covers.

15—If a Simplex coupler lock complete is applied and the lifter is new and lock block second hand, what charge can be made?

A—Item 189, second-hand lock.

16—Regarding Rules 73 and 83: To condemn wheels account worn through chill, must the spot be 2½ in. flat or 2½ in. from edge to edge of the spot?

A—Edge to edge.

17—Can a charge be made for the renewal of a defective check valve case when the brakes are cleaned at the same time. If so what change can be made?

A—No charge can be made.

18—Regardnig use of remounting gage: For uniform understanding, must this gage be held horizontally when gaging for a thin flange or must it be set flat on the tread and over the flange, leaving the gage in slightly tilted position, due to contour of wheel tread?

A—See page 98-A, 1926 rules, which shows gage resting on tread and over the flange.

19—Regarding Rule 65: Is the charge against owner proper for renewal of truck sides, arch bars, oil boxes or wedges, which have been cut through by the journal due to the brass being broken and lying in the bottom of the oil box?

A—Not covered in Rule 65; however, some interchange inspectors issue cards to include the box and wedge, when cut through by the journal. We suggest this question be referred to the A. R. A. for a ruling.

20—Rule 111. Do you recommend that an interpretation be added to rule, answering the following:

Where dirt collector is cleaned as per item 18 and dirt collector deflector and plug is found to be broken or is broken in removal, can both material charge as per Rule 101, Item 16, and labor charge as per Rule 111, Item 18, be made?

A—Yes.

21—Rule 107, Item 368: Recommend this item be revised, to show what is meant by "other sills." The question is now raised does it mean other than side or intermediate sills, or simply any other sill, and would it cover an end slll renewed at the same time?

A—Longitudinal sills only.

23—Rule 107, Items 170 and 171. Recommend that an interpretation be added, answering the following question: Where short metal draft timbers or arms are renewed and also wooden draft arm extension block is renewed at the time and the same end of the car, can a charge be made for both items, as per the above labor items?

A—The labor charge is the same for one or both items.

24—Rule 12, paragraph 5: A car moves from Road "A" to owners on June 1, then on July 1, the car moves to one or more foreign lines and back to home rails on July 31. The owner obtains joint evidence for wrong repairs and finds repair card issued by road "A" dated May 30. The owner's joint evidence is dated August 10. Can this joint evidence be considered as being obtained within 90 days of first receipt on home rails? It should be remembered that in the event of another foreign line, other than a direct intermediate, making repairs, the foreign repair card could not be considered as joint evidence. It is my opinion that the same should be true of a joint evidence card obtained by

the owner where the car has been on the owner's rails and then off again before he obtained joint evidence.

A—Joint evidence valid. Defect card should be issued to cover wrong repairs.

25—Rule 20: In adjusting the height of couplers, this rule states that empty cars measuring 32½ in. or less, shall be adjusted to 34½ in., or as near as practical thereto, but not exceeding 34½ in. Loaded cars measuring 31½ in., or less, shall be adjusted to 33½ in., or as near as practical, thereto, but not exceeding 33½ in. The Manual of Standard and Recommended Practice reads as follows: "In order to justify a bill for work done under the rules of interchange, an empty car should be adjusted to 34¼ in., maximum, 34½ in. minimum, and when it is necessary to alter a loaded car, it should be adjusted to 33½ in. maximum, 33¼ in. minimum. Are we justified in taking exceptions when heights are not in accordance with Manual of Standard and Recommended Practice?

A—See minutes of meeting Arbitration Committee, March 25, 1926. Rule 20 governs, manual to be changed.

26—Rule 70: should a defect card be issued for labor only, when applying wrought steel wheels (multiple wear), instead of cast steel wheels when the car is stencilled cast steel standard.

A—No.

27—Rule 86: Is the owner justified in using another railroad's repair card as joint evidence when wheels and axles have been changed previously by other foreign lines, when the axle is scrapped on account of length of journal being below limits of wear, claiming that axle was scrapped when applied by a foreign line.

A—This question is now in the hands of Arbitration Committee, docket 1426 and 1552.

28—Rule 107, Item 299: Slats, side or end, or side door, bolted R & R or R, per bolt, 0.3 hours: Under Rule 107, Item 179, end gate or planks, or end planks on gondola cars, and Item 374, stakes end or side on gondola cars, per bolt or rod, 0.2 hours. We would like to be advised why we are allowed 0.3 hours on item 299 and only 0.2 hours on other mentioned items.

A—The question should be handled with Price Committee. It is partly clarified by supplement 1.

29—Rule 101: We are receiving foreign cars equipped with No. 4 A. R. A. brake beams, but have no price for them.

A—No. 4 brake beams are not A. R. A. standard, the charge should be according to Rule 105.

30—Rule 111: Should any overlap labor be deducted when cylinder or reservoir are renewed in connection with air brakes cleaned at the same time?

A—Overlapping labor, 54 cents; total charge, 72 cents. Certain items of labor in connection with air brake cleaning overlap on account of renewing cylinder and reservoir, such overlap items which are not necessarily R & R account cleaning, should be charged.

31—Rule 23: When a body bolster is welded, but not annealed, can we render a bill against the car owner?

A—No.

32—Interpretation 3, to Rule 98 relative to wheels condemned by the limit gage for remounting: If a pair of wheels is removed from a foreign car on account of cut journals and it is found that the wheels are condemned by the remount gage, is it permissible to take the pair of wheels and true the journal on the axle, providing the axle can be trued without scrapping it, and replace these wheels (condemned by the remount gage) under the car from which they were removed? If such a procedure is wrong, what is the penalty for making such repairs?

A—No penalty, unless wheels are pressed off axle.

33—Does failure to apply grip nuts to box bolts on tank cars when applying box nuts on account of owner's defects, cancel subsequent charges by the same road for applying box nuts on the same bolts, account of missing?

A—No.

34—Rule 70: In view of the fact that this rule provides that wrought steel wheels (multiple wear) may be substituted for cast steel wheels, while at the same time the repairing line is changing the car owner's standard, is it the understanding of your committee that no defect card is due? If a defect card is due, how should it read, it being understood that proper charge and credit was made at the time the bill is rendered covering wrong wheels.

A—No defect card is due.

35—Rule 88: A road repairs a foreign car by applying a wrought iron coupler yoke in place of a broken cast steel yoke. Is a defect card due for labor only?

A—No.

New York Central.—This company has awarded contracts totaling approximately $758,000 as follows: to the National Boiler Washing Company, Chicago, for the installation of a boiler washing and filling system for locomotive boilers in engine-house at East Syracuse, N. Y., estimated cost $70,000.

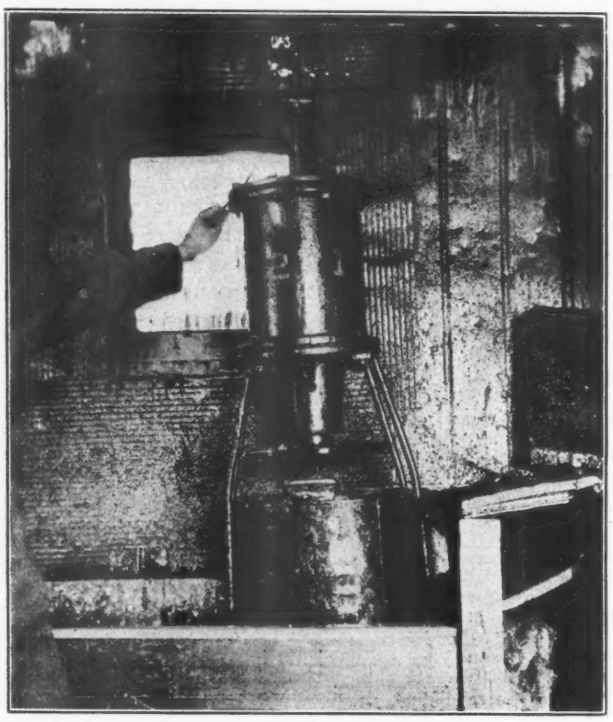
Renovating car journal packing

By Joseph C. Coyle

HOT boxes are costing the railroads thousands of dollars yearly, the greater portion of which might be saved by employing men skilled in journal lubrication, and by proper renovation.

Even where there are very good renovating facilities there is often a practice of "shaking up" old packing and replacing it in journal boxes without even washing it. Of course, many of the larger particles of foreign matter assimilated by old packing are removed in this way, but as a rule, it is not these that get under the bearings and cut the journals. The only way to remove fine particles of grit is to wash the packing in hot oil.

An excellent method of renovating old packing is that



Application of an airbrake cylinder for renovating packing

employed by the car department of the Denver & Rio Grande Western, at Denver, Col. The packing, when removed from the journal boxes, is taken to the plant and placed on a warming table until it becomes pliant. It is then thrown in a large steel tank, containing a half inch mesh screen, several inches from the bottom. This screen is covered to a depth of several inches with oil, warmed by steam pipes beneath the tank.

At one end of the tank an air press is rigged up with an old brake cylinder, as shown in the illustration. A 15-in. by 15-in. double bucket, of steel, slides on a track of angle iron beneath the press and secured to the cylinder above by four long bolts. The inner section of this bucket is perforated with small holes, while the outer part is bottomless and has a handle at the top for manipulating it. A cut-off valve, with a small vent hole bored in one side, applies and releases the air in the pipe above the cylinder. A circular plate of steel forms a pressure plate, which is secured on the threaded piston.

After stirring the packing well with a fork, it is put in the bucket and pressed, to remove the surplus oil and, with it, still more foreign matter.

Modern lacquer for railroad use*

A discussion of the nature and properties of lacquer—History of its development

By Arthur Orr

Commercial Solvents Corporation, Terre Haute, Ind.

AS the clearing house or perhaps even as the court of last resort for decisions and judgments that are bound to have a powerful effect on the future efficiency of our great aggregation of railroads you have established your reputation and in proportion as your prestige is great so must your recommendations be wise. In this instance, however, your duty is particularly delicate and difficult. You are asked to consider a material relatively new, requiring a strange technique for its application and shop facilities different from those you now possess.

When you have to choose between several types of raw material or mechanical devices each intended for the same purpose in its field and each with a long record of performance behind it, you have merely to compare the experiences of various roads, with their particular variations, and by almost arithmetical certainty, arrive at your conclusion. Definite information on cost, upkeep, factor of safety, per cent of failures and other points which enter into the equation are all available for comparison. There is not much chance of making a mistake.

In this case, although I realize of course, that any question of recommendations is premature, you are in a very different position. The facts are meager—they are based only on experimental applications stretching over a short period of time. Adequate facilities for efficient application have been conspicuous by their absence, and workmen have been generally unfamiliar with, and unsympathetic to the strange materials and tools they were called on to use. Furthermore, but not unnaturally, most of these lacquer applications have set out to imitate a paint or varnish finish pretty much as if a contractor using steel and concrete were required to build a house to look as if it were made of wood.

Your opinion, therefore, about the usefulness of lacquer for your purposes must of necessity be based on different and broader grounds than if you were considering several varieties of a definite device each with an exact record of performance behind it.

The history of lacquer

The word lacquer was first applied to an oleoresinous finish in various far eastern countries where it was developed to a very high standard of artistic and mechanical perfection. This oriental type of lacquer has been used for about 3,000 years. It dries exceedingly slowly and can, therefore, have no practical interest where time of application is a factor. Nitrocellulose, which is the distinguishing ingredient of modern lacquer, was first discovered about 80 years ago. Solutions of this material in alcohol and ether called "Collodion" found some medicinal and other minor uses. Solutions of nitrocellulose were first used industrially about 40 years ago chiefly for preventing tarnish on polished metal surfaces. Even very thin, transparent films of this old-style lacquer were found to be very effective and durable for this purpose. Until about eight years ago, however, it was impossible to make these solutions heavy enough to apply other than a very thin coat. Shortly after the war this disadvantage was overcome and today, although our commercial lacquers do not possess as much body and filling power as the average varnish, the film produced with a single coat is several times as thick as the films made with lacquers 10 years ago. This increased thickness of film made it possible to introduce inert pigments which in turn made lacquer available for use on surfaces exposed to direct sunlight. A clear lacquer film is destroyed by direct sunlight in about the same length of time as a clear varnish film, but a pigmented lacquer will withstand outside exposure without breakdown for a much longer period than pigmented oleoresinous films. This is a strong statement, but it is amply supported by the experience and the carefully conducted tests of many automobile manufacturers.

The manufacture of old-style lacquer for protecting metal surfaces has been a definite, well-established industry for over 30 years. About five years ago, with the advent of low viscosity cotton, which made thicker and pigmented films possible, the applications of lacquer began to increase very rapidly in variety and in volume. This increase was so sudden that it called for a corresponding jump in the supply of raw materials, particularly the solvents which were necessary in obtaining sound, adherent films. After some initial difficulties, this problem was solved and there is today not the slightest reason to fear any shortage in lacquer solvents or any of the other raw materials required, however great future developments may be. With the improved nitrocellulose or cotton and the ample supply of good, pure solvents which became available about three years ago, lacquer began its invasion of several industries which had never used it before.

Furniture manufacturers found in lacquer a quicker, more durable finishing material. But the most startling chapter in its history has been written by the automobile industry which has now adopted lacquer almost to the entire exclusion of other final finishing materials. All automobile companies in this country today use lacquer on some of their output. A great majority finish all their cars in lacquer in spite of the fact that most of them began its use less than two years ago. Although the priming and surfacing coats on most automobiles today are still made of oleoresinous materials, some makers use lacquer primers and surfacers as well as lacquer finishing coats.

Lacquer today is used on a variety of surfaces too numerous to mention. It is not used on surfaces where merely temporary protection is required, or where first cost per gallon of coating material is the determining factor. The true measure of value is, of course, total cost, including material and application per square foot of surface per year of life, at a given standard of appearance. Measured by this test, it is logical to believe that the use of lacquer will continue to increase for sev-

*Abstract of an address before the Equipment Painting Section convention, held at Detroit, Mich., September 14 to 16, 1926.

eral years to come. In each of the preceding three years the gallonage of lacquer produced has roughly doubled. It is estimated that twenty million gallons will be produced this year. So much for the history of lacquer development, which, after all shows how the wind is blowing, and gives us some clue to what may happen in the next two or three years.

Lacquer development hastened by automotive industry

If, as a railroad official, you were called on to make a decision on the policy your company should follow with respect to lacquer you would secure information on several points. You would study the history of lacquer development; you would make sure that its production is well established and capable of any necessary development; you would examine the mechanical characteristics of a lacquer film and the conditions necessary for the efficient production of this film on the surfaces with which you have to deal; you would also investigate its use by some great industry where the kind of surface, the exposure of this surface and the conditions of application have some bearing on your own problem.

In spite of many secondary dissimilarities the problem of the automobile producer is not unlike your own. You both want durability, ease, speed and certainty of application, good appearance, ease of cleaning, and convenience and speed in the repairing of scratches or bruises.

Some of you are now confronted with difficulties which may seem almost unsurmountable. The automobile man was in this same situation about two years ago. You are hampered by inadequate shop facilities while he has almost forgotten that he, too, had to make changes in his plant in order to insure efficient application. Your labor objects to strange new smells; the automobile spray-man today even in poorly ventilated shops, thinks no more about the smell of lacquer than a painter thinks about the smell of linseed oil. You object to the necessity of particularly thorough surface preparation; but this requirement was an even greater hardship for the automobile finisher, as he works on curved irregular surfaces and must nevertheless turn out a more highly finished surface than is necessary on railroad cars. You are troubled with chipping around rivet heads; he used to be troubled by chipping around attached mouldings. Striping and many other details have had to be worked out along new lines. You may have experienced many difficulties that he has escaped but you will escape many that he has had to overcome. Of all applications of lacquer there is probably none possessing greater economic advantages than its use on sand blasted steel surfaces.

The automobile industry has not made this effort because of any stupid, unselfish, determination to help the struggling lacquer industry. No business in the country is as cold, calculating and competitive as the motor car business. A bad decision or a good decision made too late can easily spoil a year's business. The motor manufacturer first wanted lacquer because its use made his production faster and more positive but as soon as a few makes came out in lacquer the public began to insist on it because of durability, appearance and easy, fool-proof cleaning. Some automobile companies have already had good reason to regret their procrastination in adopting it.

Public favor is not an important factor in your case. While production speed, inventory tie-up and floor space are all more important to the motor car producer than they are to you, and resistance to sulphur fumes and to the high temperatures of some parts of a locomotive surface are secondary advantages that do not attract him, the fundamental advantages are about equally useful to both industries.

Your careful study of the use of lacquer by motor car manufacturers and refinishers will bring out far more completely than I have outlined, the points of resemblance and difference, the respective advantages and disadvantages peculiar to their industry and to your own. You will now be ready to investigate the experiments with lacquer made by railroads and car builders. If you are already familiar with modern automobile practice and results you will be better able to make proper allowance for the inadequate facilities, uncertain technique, high cost and mediocre result that has naturally characterized much of this new work.

What the railroads use lacquer for

In order to get some idea of what the railroads are doing with lacquer, a questionnaire on the subject was sent to 20 of our representative lines. The 20 were chosen by a man who knew something about railroads but nothing about lacquer.

Two out of these 20 roads are using no lacquer on their equipment either experimentally or otherwise. My further remarks, in this connection, will apply only to the remaining 18 companies. One company, which began experimenting in 1924, has recently standardized on lacquer for outside finishing on all passenger equipment and locomotives. One railroad began its experiments in 1923; five in 1924; six in 1925, and the remaining six during this year.

The 18 companies who use lacquer have applied it to approximately the following equipment:

Sleeping cars—399, of which 25 were lacquered inside as well as outside.
Passenger coaches—255 (18 lacquered inside also)
Baggage, mail and express cars—13
Dining cars—5
Horse express cars—10
Gas-electric motor cars—5
Observation cars—1
Passenger locomotives—284
Freight locomotives—880

This gives a total for these eighteen roads alone, of 1,164 locomotives and 688 cars. Several of these 18 companies say that their work is still practically in an experimental stage; some of them add that the outlook is favorable.

Advantages and disadvantages

These companies were also asked to state what they considered the principal disadvantages and advantages resulting from the use of lacquer. I have drawn up two lists giving these points in their order of importance as shown by these questionnaires.

The disadvantages are as follows:

1. Need for new shop facilities and equipment.
2. Cost of material.
3. Odor during application.
4. Difficulty of application.
5. Necessity for special surface preparation.
6. Difficulty of lettering and striping.
7. Chipping around rivet heads.
8. Fire hazard.
9. Trouble with labor.
10. Difficulty of cutting in on group repairs.
11. Chalking on exposure.

The advantages in the order given:

1. Speed of drying.
2. Durability.
3. Less total cost.
4. Easy to clean.
5. Better appearance.
6. No baking equipment or process required.
7. Easy to repair scratches, bruises, etc.

I will not dwell too long on a comparison of these two lists, but will merely point out that the objections have more to do with conditions surrounding application than

with the final results. The stated advantages, on the other hand, constitute really a list of most of the fundamental advantages inherent to lacquer. Given adequate facilities, intelligent supervision and a few months' experience, all these comparative disadvantages would diminish. They have largely disappeared in the automobile industry. In proportion as the difficulties decrease so will the advantages increase.

If in an industry as great and as old as the railroad business in this country and in Canada, there happen to be some compnies in which buying has come to be done on a basis of friendship rather than merit, this would not be surprising. These few companies will undoubtedly, if they make any experiments at all, find that lacquer is very unsatisfactory, and decide to continue with the materials they have been accustomed to using. It is no trick at all to get bad results with good lacquer when good results would be unwelcome.

Perhaps you have guessed that I have much confidence in the future development of lacquer and in the advantages that go with its use. But let us be quite honest and admit that the good things of this world are not acquired without effort. If a fair investigation of all the factors leads you to the conclusion that lacquer should be given a fair trial, be prepared to spend money and effort and above all to keep an open mind. The period of transition will be hard in some cases but I predict without hesitation that you will all have passed through it before many years have gone by.

Discussion

One member questioned the advisability of spraying locomotives, for example, with lacquer at the same time that oxy-acetylene welding or cutting torches are being used in the vicinity, owing to possible fire hazard. This member also asked if the odor of lacquer is seriously objectionable to workmen. Mr. Orr replied that lacquer vapors are inflammable and certain precautions must be used. He said that while not wanting to minimize the fire hazard, the possibility of danger in using lacquer has probably been exaggerated and is not appreciably greater than that involved in the use of other finishing materials to which railroad men are accustomed. Regarding odor, it may take longer for men to get accustomed to the smell of lacquer than to the smell of some other materials, but there are many shops in the country in which lacquer has been used day in and day out for years. Men have ceased to notice it and none have suffered ill-effects.

Another member asked about cleaning, and Mr. Orr replied that experience with the cleaning of lacquer proves it to be much easier, cheaper and quicker to clean, particularly if polished, than any oleoresinous surface. The question of polishing was raised and its advisability considered doubtful. Regarding the brushing of lacquer, two years ago this would have been considered impossible owing to its quick-drying properties. By using materials which delay the drying, however, practical brush lacquers have been developed. On wooden coaches special lacquer must be used with greater possibility of film stretch than is needed on steel equipment. There has been less advancement in this particular type of lacquer than in that suitable for use on steel. Subsequent discussion regarding the application of lacquer over old material developed that this is permissible providing the adhesion of the original material is still sound. Owing to the possibility of trouble, however, it is safer to remove the old material. Questioned regarding the durability of lacquer, Mr. Orr replied that given equal thickness and a good job in each case, lacquer has greater resistance to abrasion.

Speeding up the testing of triple valves

By J. C. Coyle

A CONSIDERABLE saving of time, in testing the air on cars at the Denver shops of the Denver & Rio Grande Western, is made by using the device shown in the illustration. The ordinary procedure in testing air was to attach the gage first to the triple valve exhaust

The testing of triple valves may be speeded up by the addition to the gage of a short section of hose and a pet cock and connection

port, then to the retainer pipe. By the addition to the gage of a short section of hose and a pet cock and connection, it is connected to both the retainer and the triple valve exhaust port, the former being tested by opening the pet cock, and the latter with it closed.

No lead poisoning at Pullman works

THE February issue of the Pullman News contains the following interesting quotation from Dr. A. M. Johnson, engineer of tests, on the way dangers from lead poisoning of painters has been practically eliminated at the Pullman car works:

"Years ago we realized the necessity of devoting special attention to our painters as, when much lead gets into the system, a painter gets plumbism, commonly known as lead colic. This is acquired chiefly by a painter eating food without thoroughly washing his hands, or by inhalation of the paint dust when sanding a painted surface. About 1911 we made changes in the white lead used and this greatly lessened the toxic effect, and we also installed excellent sanitary equipment and supervision and regular medical inspection. All this caused a phenomenal reduction in lead poisoning. For instance, during the first six months an average of 489 men was examined monthly and 109 cases of plumbism found, or an average of 18 a month. During the next two months an average of 649 examinations was made and 16 cases found, an average of 8 a month. During the next 13 months (during which the paint changes and sanitary and medical supervision were well developed) an average of 639 men was examined monthly and only three cases found. Thus the

lead poisoning fell from an average of 18 a month in a force of 489 men to 3/13 cases among 639 men employed at the Pullman works.

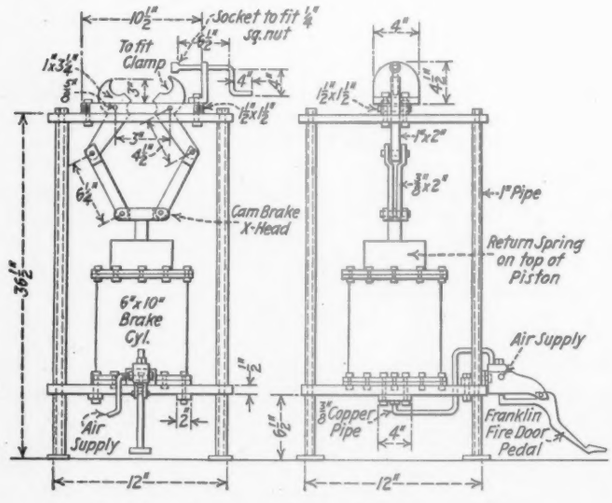
"In recent years a paint pigment known as titanox has been produced, which we successfully experimented with as a possible substitute for white lead, the basis of our interior paint and, because of the necessity of sanding inside paint to prepare suitable surfaces for finishing, the main danger of lead poisoning. In some respects the new pigment was even superior to white lead, and a change in standardization of ceiling enamel was a result. Later its use was standardized in all the ground colors, both walnut and mahogany, which furnish the foundation paint system on the interior of cars preparatory to the graining and varnishing. So we have, practically speaking, eliminated lead from our interior painting, which was our chief source of lead poisoning.

"The paints used on the outside of the cars are not on a lead base, and what little lead may be there offers practically no liability of poisoning, since there is no dry sanding. The only rubbing done is on the first three coats of the so-called surfacing, and this with rotten stone and water, which produces no dust.

"In the steel erecting department, where the steel framing of the car is assembled, it was the practice of many years to use red lead for sealing joints and abutments to prevent corrosion. A high grade iron oxide paint is now used, thus eliminating any poisoning possibility here."

Air hose clamping machine

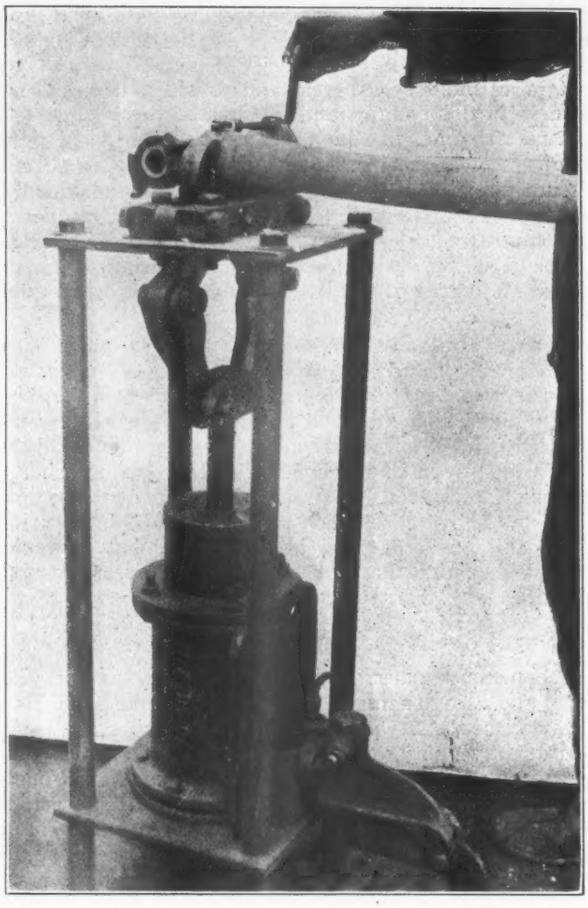
IN fitting up air hose one of the most important operations is quickly and securely to apply the clamps and bolts. Under the old methods the operation was handled at the rate of from 15 to 20 hose per hour, but due to the yearly increasing business and the study given



Details of the air hose clamping machine

to all the operations in the repair shops, the air brake department of the Emerson shop of the Aalantic Coast Line designed the simple machine shown in the illustrations with which 60 air hose per hour can be properly clamped and bolted.

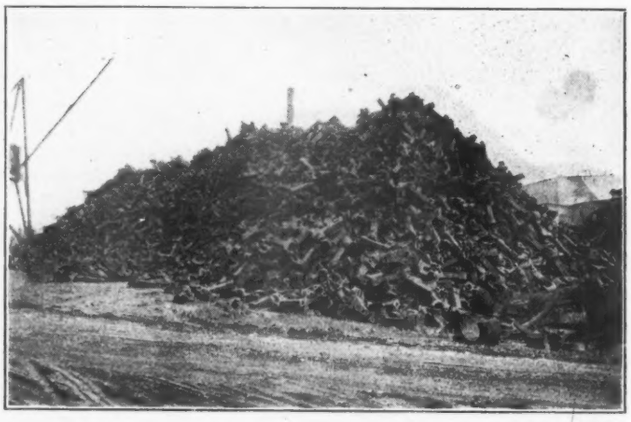
The clamping is done by a scissors type arrangement with jaws that fit around the clamp. A 6-in. air cylinder, operated by a foot pedal furnishes the power. When air is admitted, the piston in the cylinder moves upward which causes the jaws to come together, closing the clamp uniformly around the air hose and leaving free the ends of the clamp for application of the bolt. A small hand operated crank socket is attached to the ma-



With this device 60 air hose per hour can be clamped and bolted

chine close to one jaw by which the nut is quickly run up and tightened.

The description of this device was furnished through the courtesy of the Atlantic Coast Line News.



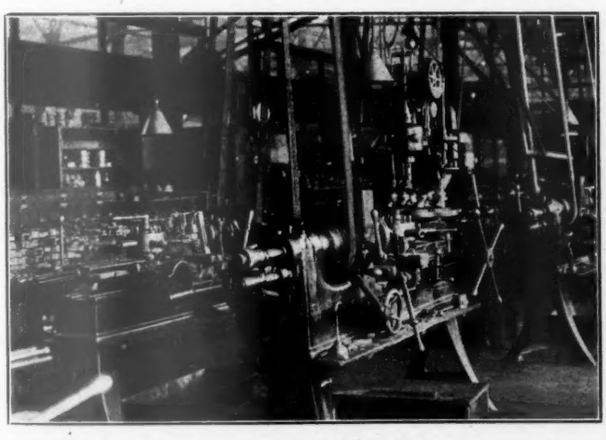
Scrap couplers at the Falk Corporation's plant, Milwaukee, Wis. The pile is estimated to weigh 4,700,000 lb. and contains 23,500 couplers. Their scrap value is $36,000

Brass and air brake departments of B. & M. Billerica shops

Equipment and method of handling and inspecting work— Operators do not have to sharpen tools

By J. Murray Cairns
Foreman, Boston & Maine, Billerica, Mass.

THE Billerica shops are the principal locomotive repair shops of the Boston & Maine. Practically all of the classified repairs on the system's locomotives are made at this point. In addition, the machine shops manufacture and repair locomotive



Some of the turret lathes for turning brass parts

parts for all points on the system. Thus, the brass and air brake departments at these shops are required not only to handle work originating in the locomotive erecting shop, but must repair, on shop orders, brass and air brake parts for all other small shops on the system.

This department, which occupies a floor space of 150 ft. long by 40 ft. wide, is on the balcony located in the locomotive repair shop. A 1½-ton monorail electric crane runs the length of the department. The following machine tools are provided for handling the work:

Brass work

No.	Size	Type	Manufacturer
4	16 in.	Turret lathes	Warner & Swasey
2	18 in.	Turret lathes	Warner & Swasey
1	18 in.	Turret lathes	Foster
1	Small	Vertical drill	Prentiss
1	36 in.	Vertical drill	Baker Bros.
1	No. 50	Internal grinder	Heald
1	No. 55	Internal grinder	Heald

Air brake work

1	18 in.	Lathe	Prentiss
1	16 in.	Lathe	Prentiss
1	36 in.	Boring mill	Bullard
1	8 Spindle	Angle cock grinders	Turner (Horizontal)

Ample room is provided for test racks, work benches,

The tool cabinet which contains 156 drawers in which sharpened tools are kept for each part to be machined

tool cabinets and portable material trays. This department is supervised by one foreman, one assistant foreman and two piecework inspectors, under whom are 27 machinists, three machinist helpers, one laborer and one messenger, or a total working force of 31 men. With this equipment and working force, the following output has been obtained:

Air compressors repaired during 1925

Size	No.
9¼ in.	1,051
11 in.	24
8½ in. by 8½ in.	47

Other locomotive parts repaired from July 1, 1925, to January 1, 1926

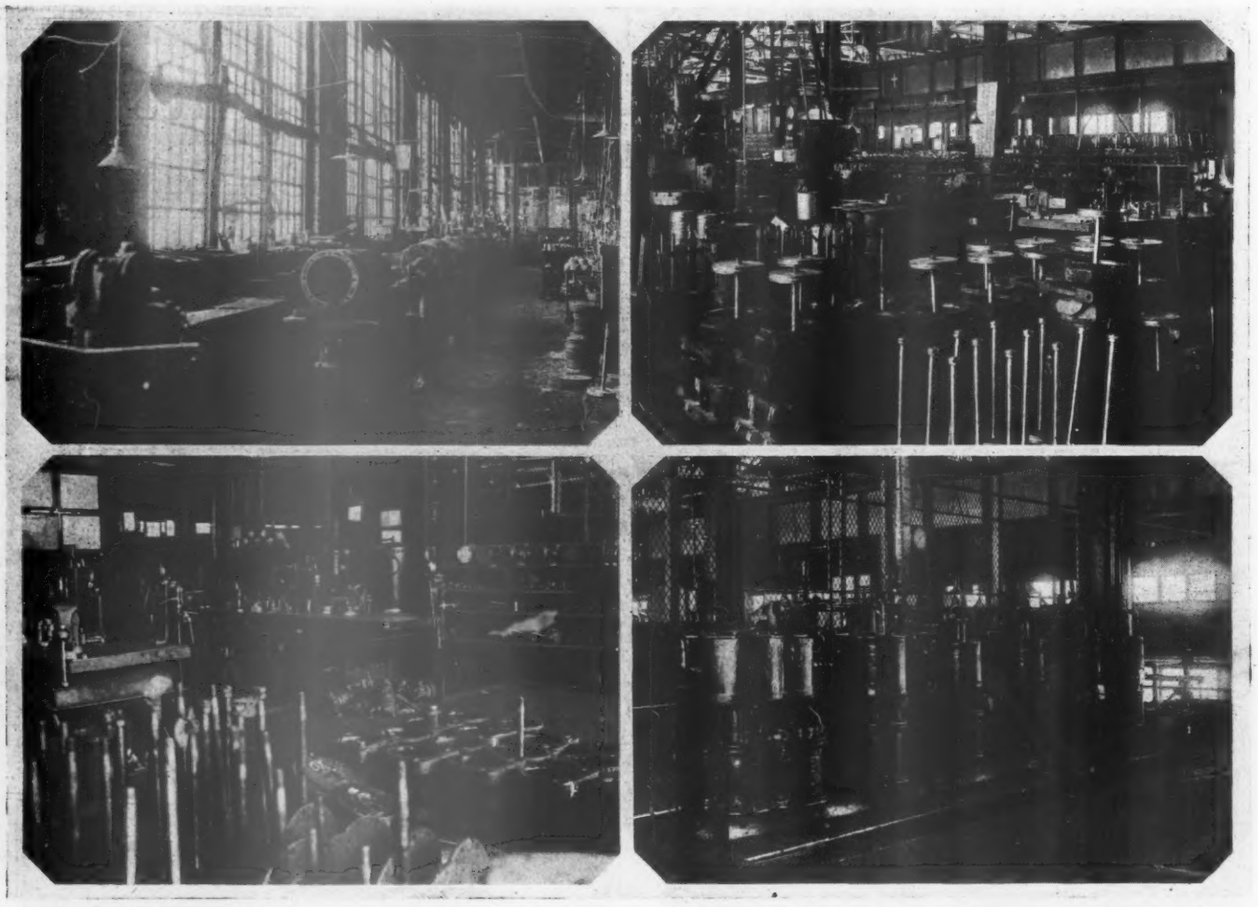
Item	No. Repaired
Triple valve (engine and tender)	89
Distributing valves	314
Feed valves	1,193
Brake valves	308
Fire door cylinders	167

Here the parts are separated and those which require cleaning are sent to the cleaning vat where they are boiled and rinsed.

The cleaning vat, which holds about 300 gallons of cleaning solution, is divided into a boiling and rinsing compartment. The first is 6 ft. by 4 ft. by 4 ft., and the latter is 4 ft. by 4 ft. by 4 ft.

When the cleaning solution is made up with caustic soda, two ounces per gallon are used, and when made up with Oakite cleaning compound, 4½ oz. per gallon are used. The solution is heated by steam coils. The vat is cleaned out about every 15 days, depending on the condition and the number of parts cleaned. The parts are allowed to remain in the cleaning solution from two to three hours.

After the parts have been cleaned, they are placed in boxes on a shelf until they are ready to be repaired.



Upper left—A line of air compressors mounted on adjustable work stands; Upper right—A general view of the air compressor repair department; Lower left—A corner of the air brake department, showing the testing rack; Lower right—Air compressor testing rack

Angle cocks	2,939
Safety valves	1,146
Lubricators	158
Steam and air gages	1,198
Inspirators	463

Repairing locomotive fittings

When the locomotive fittings are stripped from the locomotive, they are tagged with tin tags and placed in a steel box 16 in. by 20 in. by 36 in., which is large enough to hold the equipment of any locomotive. The box is delivered to the floor under the balcony where it is lifted to the brass department by a monorail crane. As such parts as lubricators, safety valves, whistles and air brake valves are repaired, they are placed on separate shelves, as shown in one of the illustrations, ready to be delivered to the locomotive. As soon as those parts, necessary to be on a boiler are tested and repaired, they are delivered to the locomotive.

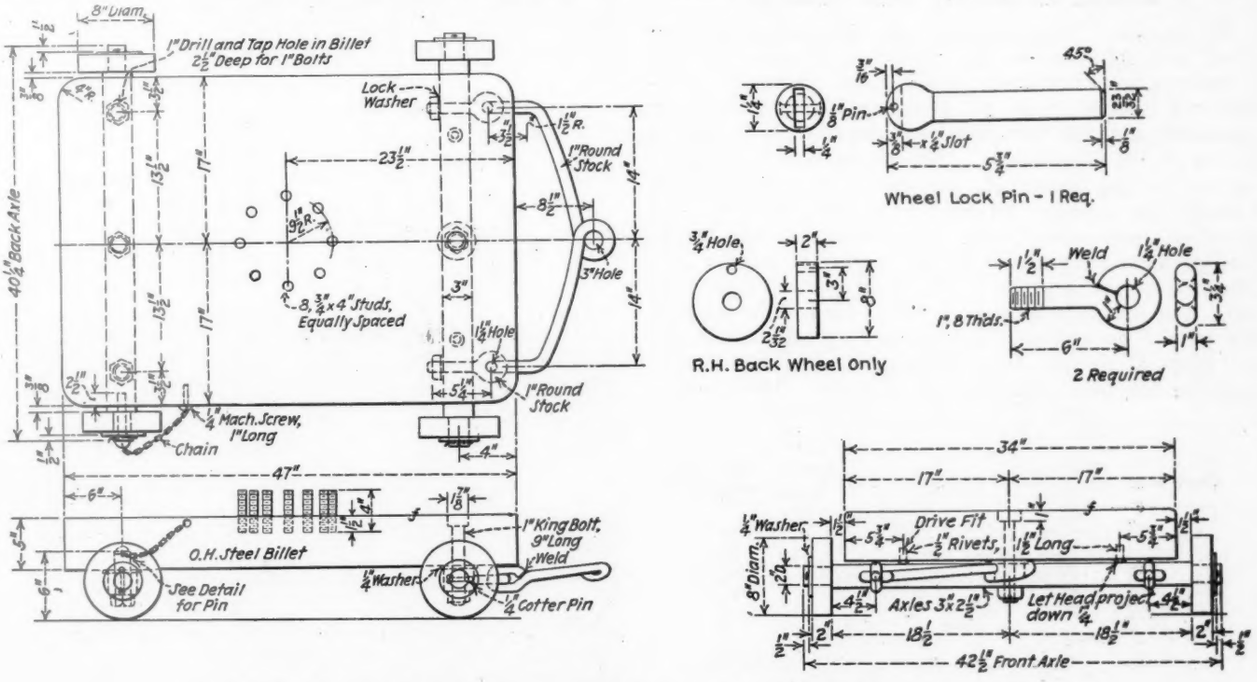
Each repair man keeps a book record of all work done on such parts as injectors, lubricators, safety valves, whistles, cab valves, air compressors and brake valves. This record shows the time the part was delivered to the repair bench, what locomotive it is for, the time it

is scheduled out and the time the part was repaired ready for delivery. With this record, it is an easy matter to check up defective repair work where more than one man is working on the same class of work. It also helps to settle disputes with other departments as to whether work has been finished and delivered.

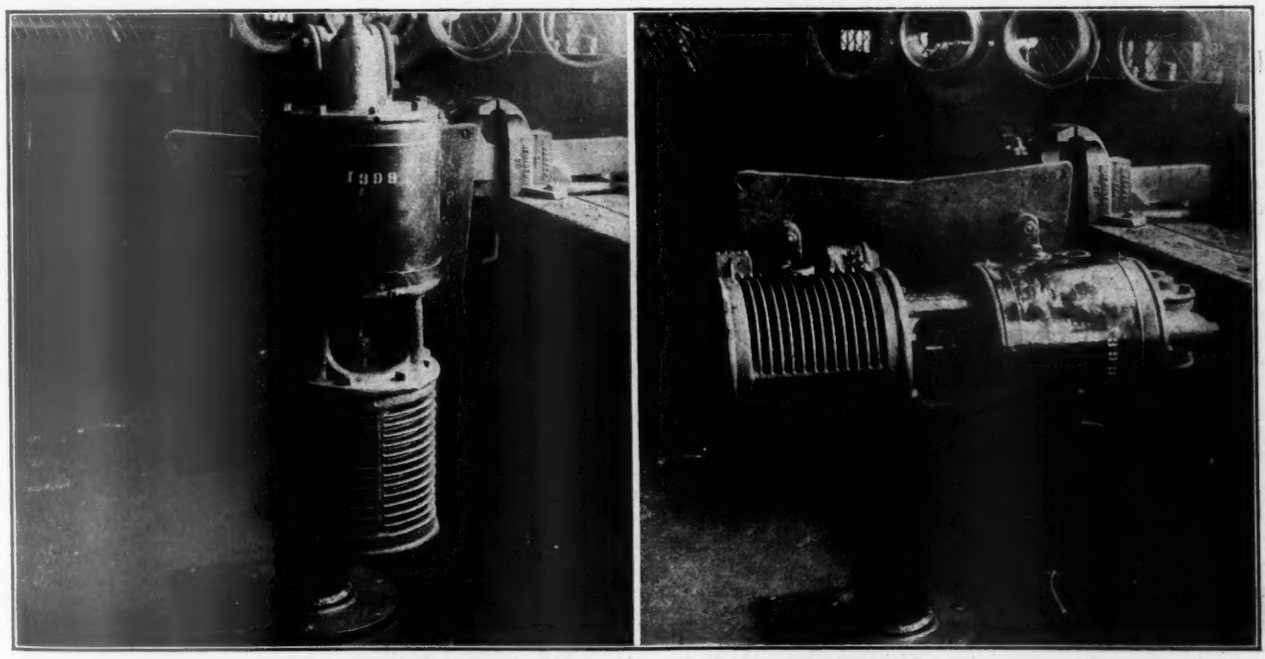
The repairmen working on the principal jobs, such as mentioned above, every Monday morning are given a revised schedule for the week. This schedule is based on the master schedule kept in the locomotive repair shop. Every Friday the foreman checks up with each man as to the schedule given. Under this system the work is always ahead of the other departments.

Piecework inspectors

There are two piecework inspectors who are responsible for the quantity and quality of the work turned out. These men are under the general piecework inspector and co-operate with the foreman and assistant foreman in the various departments to which they are assigned. Their duties principally consist of making out all of the piece work and day work time



Details of truck used for hauling the Worthington feedwater heater about the shop

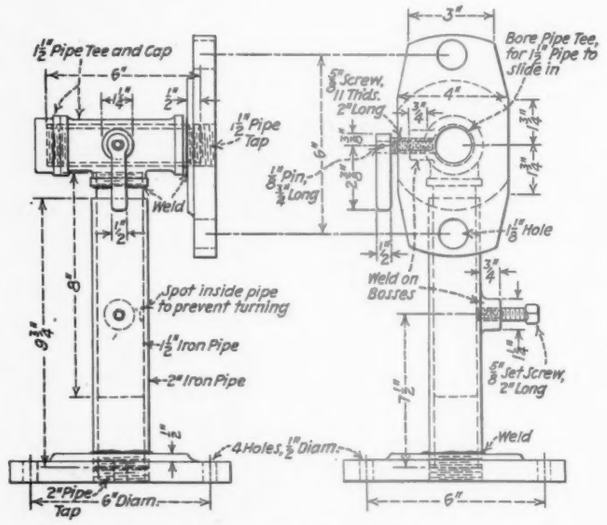


The revolving air compressor stand in the vertical and horizontal positions

cards and of inspecting the finished work. They use limit gages for this work mostly of the plug type. All the work rejected by the inspectors is checked up by the foreman and, if found wrong, the operator is held responsible.

Method of handling brass castings

All standard brass castings are finished on a shop order and delivered to the stores department for distribution at other points on the system. When the castings are received from the stores department, they are separated and put into traveling trays, such as shown in one of the illustrations. These trays are lined up at one end of the department until ready for the operator. Usually the assistant foreman keeps two or three jobs ahead of each turret lathe. The trays are wheeled to the machine with the necessary tools to do the job. These tools are kept in a cabinet, sharpened ready for use. The operator is also furnished with a blueprint of the job. The blueprint is mounted on stiff cardboard and then shellaced. The work order is hung on the machine for the inspector's information. The finished



A work stand for holding lubricators

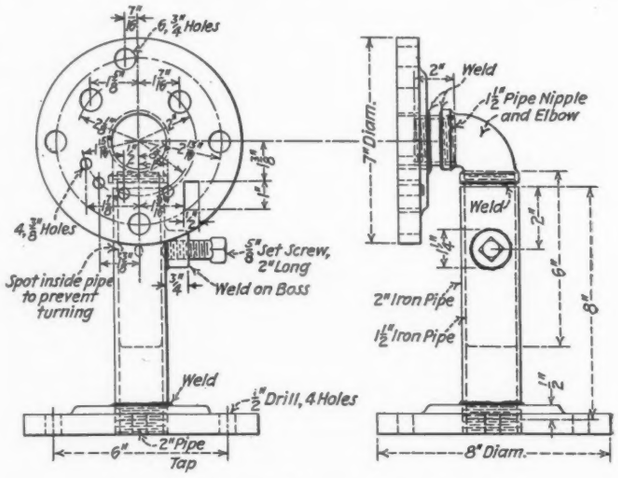
castings are shipped to the stores department every day at 3 p. m. After the operator has finished a certain job, the tools are taken to a designated place where a machinist is assigned to inspect, sharpen and place them in the proper drawer in the tool cabinet. With this system, the operator does not have to keep his tools sharpened and, furthermore, if a tool is not properly sharpened, the responsibility can be quickly placed.

The tool cabinet is divided into 156 drawers, each one holding the necessary tools for machining a certain part. A sample of the part to be machined is in each drawer. Each drawer has a brass plate above the handle, numbered and lettered with the name of the part for which the tool is to be used. The drawers are numbered in rotation, and any tool, or tools, can be easily found by consulting an alphabetically listed index chart which is in a frame at one end of the cabinet.

A show case, 6 ft. by 4 ft., which contains samples of all the brass parts machined in this department, is conveniently located in the shop. The samples, which are polished and lacquered, have a pattern number stamped on them. These sample castings have proved very convenient as there are always questions arising about them and when they do, we have them right at hand.

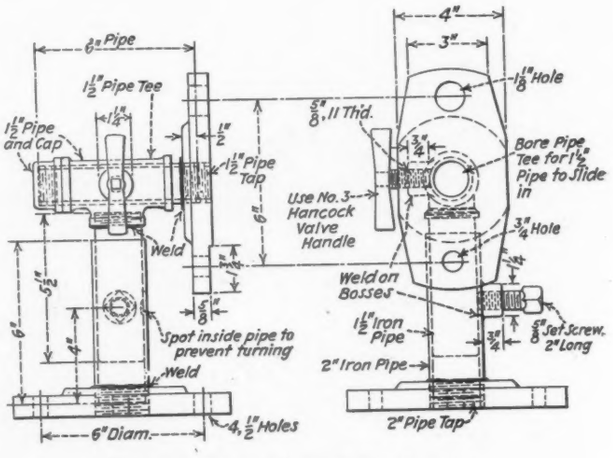
Repairing air brake parts

Practically all of the air compressor repair work for the system is handled at this shop. All compressor cylinders which have to be ground are stripped from the center casting and sent to the cleaning vat where they are thoroughly boiled and cleaned. They are then sent to the grinders. After the compressors are assembled, they are tested out by air on assembling stands, from



A distributing valve work bench stand

which they are sent to the steam testing rack where they are again tested and allowed to run for a designated time. When the pumps are applied to the test rack, they are painted with a spray machine, which requires about five minutes for each compressor. By the time the compressors are tested, the paint is dry, after which they are stencilled with the engine number and placed in storage until the time they are to be delivered to the locomotive. The test rack will hold one 8½-in. by 8½-in. one 11-in. and four 9½-in. compressors.



Brake valve repair work bench stand

The air brake valves are handled in a manner similar to the brass valves and car equipment, only they are lined up at the other end of the department. An effort is made to keep everything in its own place.

Air pump assembling stand

The framework of the air pump assembling stands is made from a piece of 6-in. iron pipe, with a flange

riveted to a square piece of ½-in. boiler sheet which is bolted to the floor. The table and plate, which revolves on ball bearings, is bolted through the pipe by one bolt. Below this bolt is a pin or dog, with a spring to which a handle is attached. Four holes are drilled in the plate for the pins to enter, making it possible to work at the compressor in four different positions. In order to change the position of the compressor on the stand, it is only necessary to pull out the handle and turn the table until the pin strikes the next hole in the plate.

Lubricator stand

The purpose of the lubricator stand is to enable the workman to get at the lubricator in any position. It is made entirely from pipe and scrap castings. The lubricator is bolted to a stand which is made from a scrap air compressor piston head. The base is tapped for a

The top view shows the finished parts and the schedule board and the lower view shows the traveling work trays, repair bench for steam gages and the tool cabinet

2 in. pipe, into which is screwed a piece of 2-in. pipe 9¾ in. long. Inside of this pipe is a piece of 1½-in. iron pipe, on the end of which is screwed a 1½-in. pipe tee with a cup on one end, the other end taking a piece of 1½-in. iron pipe the length of the tee, which in turn is screwed into the casting on which the lubricator is bolted. About midway on the main piece of pipe is a bronze welded boss which is tapped out for a set screw with a tee handle attached to locate the stand in any vertical position. Another boss is welded on the side of the pipe tee, with a set screw and handle inserted for turning the lubricator around to different positions.

The distributing valve and brake valve stands shown in the accompanying illustrations are made in the same way, only to suit different types of valves.

Avoiding delay when a valve gear breaks

A VALVE motion has not yet been designed that will not, at times, develop a defect that will cause a failure of some of the many parts, but with the Walschaert gear properly maintained, failures are

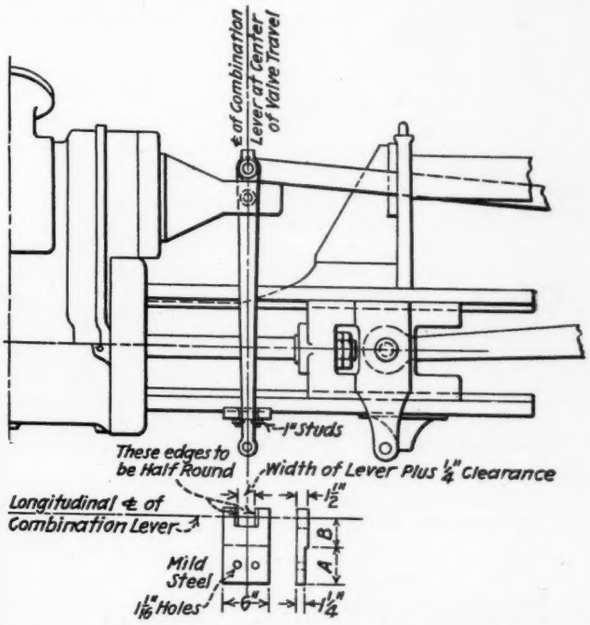


Fig. 1—Forged bracket attached to the bottom guide bar to hold the combination lever central

reduced to a minimum, and even with the breakage of some part it is possible in nearly every case to come along without disconnecting one side of the locomotive and still

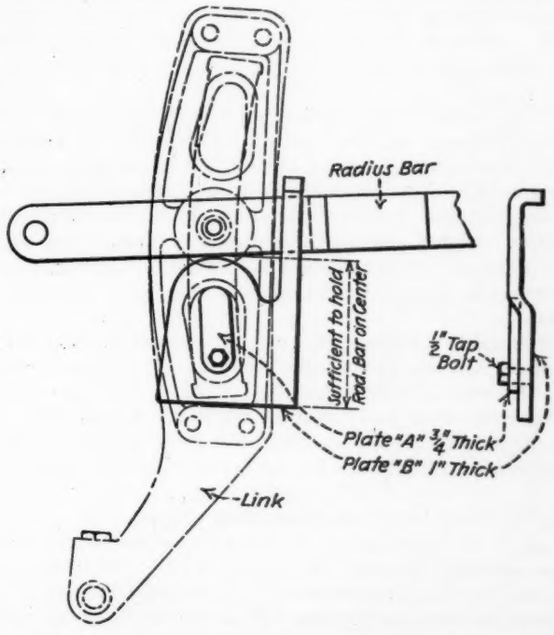


Fig. 2—Plate used to block the link in case of a failure

getting more than half power without the possibility of getting on the dead center.

The accompanying illustration is from suggestions

worked up in the Wilmington, N. C., shop of the Atlantic Coast Line, which, when used on actual trial, gave good results.

Fig. 1 of the accompanying illustrations show a forged bracket attached to the bottom guide bar either with studs or cap screws. This bracket merely holds the combination lever central when defects occur in the crosshead bracket, connecting link, or any pins used with these parts. The bolts for application of this bracket, should be put in at the shop and the bracket carried with other equipment, for an emergency.

When the combination lever is held in the position shown and the other parts are disconnected from the crosshead, the eccentric will give sufficient port opening to handle any ordinary train without the lead opening which is not obtained under these conditions.

Fig. 2 shows a plate used to block the link in case of a failure in the ecentric crank or rod. After removing the parts and disconnecting the lifting arm from the reverse shaft, apply the plate to the link, which will hold the radius bar in its central position. Then, with all the parts in operation from the crosshead, the port opening will be the amount of the lead opening of the valve. This is perhaps not enough to handle much more than half the capacity of the locomotive, but it will make unnecessary any disconnecting on the disabled side with the possible attendant difficulty of getting on dead center.

The information contained in the article was taken from a recent issue of the Atlantic Coast Line News.

Bronze-welding copper*

MUCH has been written about the welding of commercial copper in its various forms. Lately this problem has been investigated from a relatively new angle and with success. Stated briefly, the latest American practice recommends that copper work requiring high strength, unity of composition and high ductility, be done only on specially deoxidized copper for a base metal. It is now possible to purchase such copper, deoxidized with silicon, manufactured with the view of giving it the best welding qualities.

Starting with this base metal, the welding is done with a special copper rod containing silicon, using a neutral flame. The work is carried on quickly at the lowest possible temperature for satisfactory fusion. Silicon in the welding rod protects the base metal from undue oxidation. This practice, carefully followed out and supplemented where possible by annealing or hammering, or both, gives a weld that is satisfactory in all particulars.

For much copper work, such as repairs on existing equipment, or the use of stock sheets, metal deoxidized with silicon is not available. Many coppersmiths, maintenance men and steamfitters have found that a joint, tight and strong enough for most purposes, can be made in ordinary stock copper with bronze welding rod.

The technique for bronze-welding copper pipe, copper castings, and copper sheet, is almost exactly the same as bronze-welding on steel or on cast iron. The parts to be joined are put into contact and must be heated to a temperature which will show red in the daylight, or just to the point where bronze will unite with the base metal, and a tinning layer of bronze is flowed on. Brazo flux is used freely in applying this first layer of bronze. After a surface has been tinned, bronze is built up on it to a proper thickness and width for the required joint. This work can progress along the seam in sections, tinning and building up 2-in. stretches one at a time.

On copper castings and material over ⅛-in. thick, it is best to bevel the edges. Welding is then done in the same way as described above. Considerable care must be used to see that the tinning coat is carefully and thoroughly applied to the bottom of the joint. The work should be completed as rapidly as possible, and with a minimum of heat. Special care should be taken not to heat the copper any further back from the weld than necessary. To provide for this last factor some oxwelders build up ridges of wet asbestos cement along the weld, far enough back so that these will not interfere with the work. If these tend to dry out they can be kept wet by adding water from time to time.

*An abstract of an article which appeared in the August issue of *Oxy-Acetylene Tips*, published monthly by the Linde Air Products Company, New York.

Special tools for machining tank valve bodies

By J. H. Hahn
Machine shop foreman, Norfolk & Western, Portsmouth, Ohio

THREE special tools that can be used to good advantage for machining cast iron tank valve bodies are shown in the accompanying illustrations. They are of the inserted blade type made of high speed tool steel with bodies of carbon steel. The tools are designed for use on small turret lathes, boring mills or engine lathes. When used in an engine lathe the tool is placed in the tail stock and the tank valve body is chucked in the lathe in the usual manner. The tool is fed into the work with the tail stock as is done when drilling a hole on the lathe. One operation at a time is handled in this manner.

Special tools for machining tank valve bodies

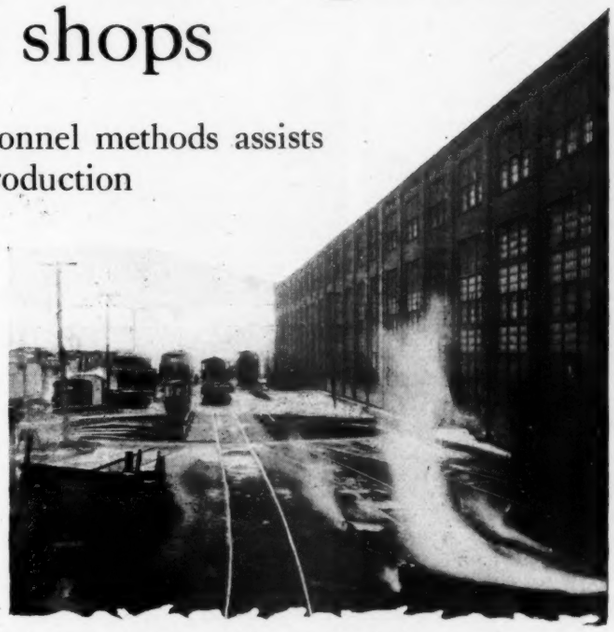
For example, a lot of 25 tank valve bodies is to be machined. We will put in the tool for facing one side and complete this operation on all 25 of the castings, then remove this tool and put in the one for facing the top and machining the seat. This operation is completed on all 25 of the seats, after which this tool is removed and the tool for finishing the tank valve bodies is put in place. The third operation completes the tank valve bodies. When using turret lathes or small boring mills the operations are about the same.

These tools are easily constructed in the average tool room.

Lehigh Valley has well organized system shops

Efficient application of modern personnel methods assists in obtaining increased production

Part I



Turntable at the entrance to the locomotive shop

THE recent controversy between the followers of Bill Brown and Top Sergeant in these columns, showed that there are still a number of mechanical department men who are skeptical as to the results that can be accomplished through the application of modern personnel methods. For some time the *Railway Mechanical Engineer* has felt that perhaps the most convincing argument in favor of the utilization of modern personnel methods would be to publish a description of the operation of some shop in which real results were being obtained through a well planned organization and administration of the shop forces. Considerable space has been devoted in these columns to the subject of foreman and apprentice training, among the examples cited being the system shops of the Lehigh Valley, Sayre, Pa., where an established policy of personnel and employee welfare work has been in operation for a number of years.

In order to get a complete picture of the system of operation at the Sayre system shops, a brief history of

The rod department is shown in the foreground—the turret lathe and air brake departments are located near the entrance shown in the background

the development of personnel work on the Lehigh Valley should be given. In December, 1920, a short time after the railroads were returned to their owners by the government, E. E. Loomis, president of the Lehigh Valley, came to the conclusion that more care should be given to the selection of new employees and in preparing them for and installing them in their new jobs. Also, that these men should be followed up and a system of service records developed for each man in the organization.

There are seven operating divisions on the Lehigh Valley and one man was selected from each division to report to the division superintendent and devote all of his time to the personnel question on the division. These men were given the title of supervisors of employment and they are held responsible for the careful selection, placement and development of the new employees. Of course, the object of this work is to reduce labor turnover and the resultant expense, cut down the number of mistakes and the amount of damaged work, reduce the number of injuries caused by inexperienced men and give the employees a greater sense of security. The desire of the management is that the workers be satisfied.

Employee representation

About 25 per cent of the employees of the road, or 30 per cent of all operating department employees, are in the shop crafts. In 1922 the shop crafts employees formed "The Association of Maintenance of Equipment Employees of the Lehigh Valley Railroad." This includes all of the gang leaders, mechanics, helpers, apprentices, etc., but not the supervisors. A local committee (division or general shop) is formed at each point by electing representatives from each craft on the basis of one committeeman for the first 49 members, two for 50 to 200, three for 201 to 300, etc. Candidates for these positions are nominated on the first Monday in May and an election by secret ballot is held on the third Monday of that month. Nominations are made by petition, which must be signed by 25 voters or 25 per cent of the voters in the craft in the election district. The local committeemen elect their own division or general shop chairman.

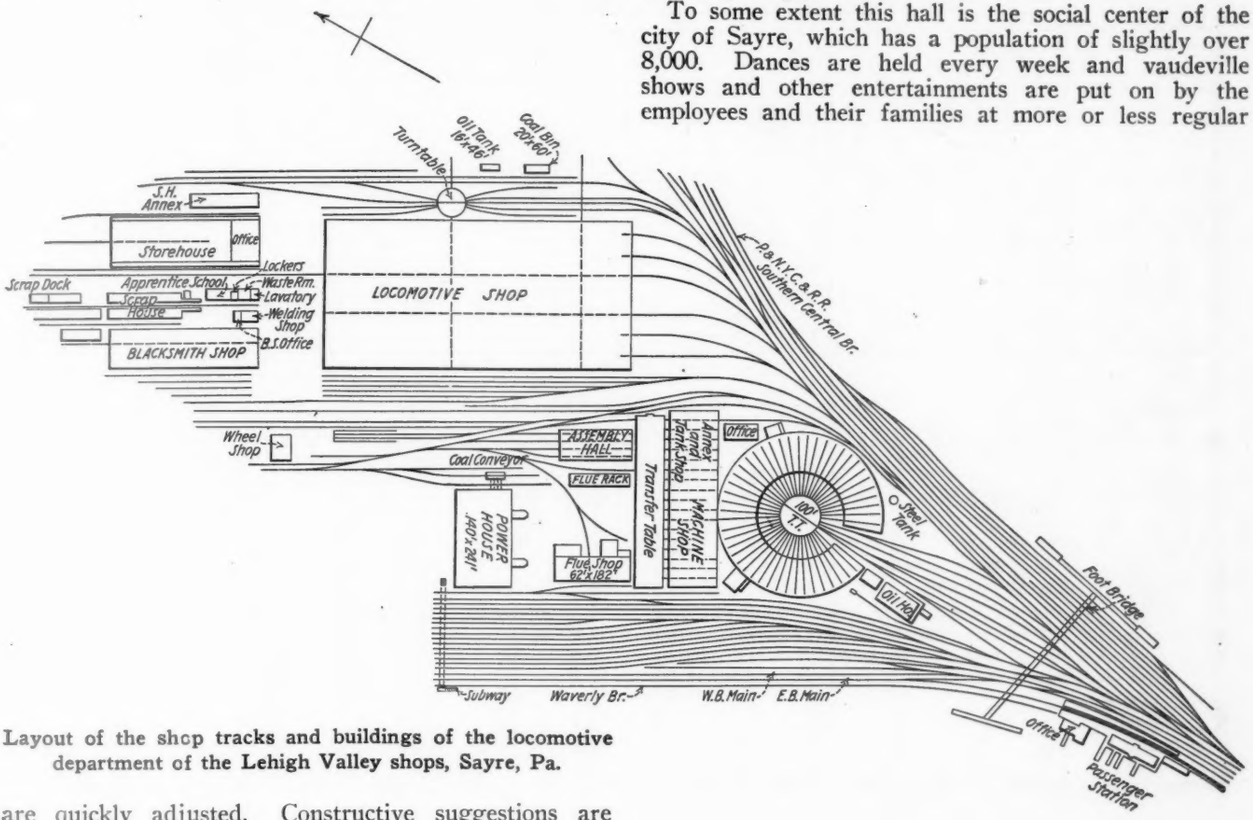
A general system chairman representing all maintenance-of-equipment forces is elected for a term of two years by the local chairmen of all crafts; general system craft chairmen of each craft are elected for a term of two years by the local chairmen of each craft. The general committee is composed of the general chairman and the general craft chairmen.

All grievances must be acknowledged and disposed

Fig. 1—The assembly hall; Fig. 2—Class at work in the apprentice school room; Fig. 3—Interior view of the dancing hall and theatre; Fig. 4—Banquet held by the shop crafts in the assembly hall, February, 1926; Fig. 5—Scene in the cafeteria during lunch hour; Fig. 6—The bowling alleys; Fig. 7—Baseball team of the Sayre Shops

of by a general foreman in seven days and by a master mechanic or shop superintendent in 10 days. Questions which cannot be settled by the local committees and the local officers are referred to the general committee for decision. If for any reason the general committee cannot come to an agreement with the superintendent of motive power, the question is referred to a joint board, consisting of the general committee, with an equal number of representatives appointed by the management. It is significant that although this type of organization has been in effect about four years, no controversial question has yet been referred to the joint board.

The clerks and maintenance-of-way employees have similar associations. The change in attitude of the shop crafts employees toward the management since July, 1922, is little less than remarkable. Grievances



Layout of the shop tracks and buildings of the locomotive department of the Lehigh Valley shops, Sayre, Pa.

are quickly adjusted. Constructive suggestions are being made by the men and they are uniting with the management in trying to improve the condition and the prosperity of the road.

Shop crafts activities at the Sayre system shops

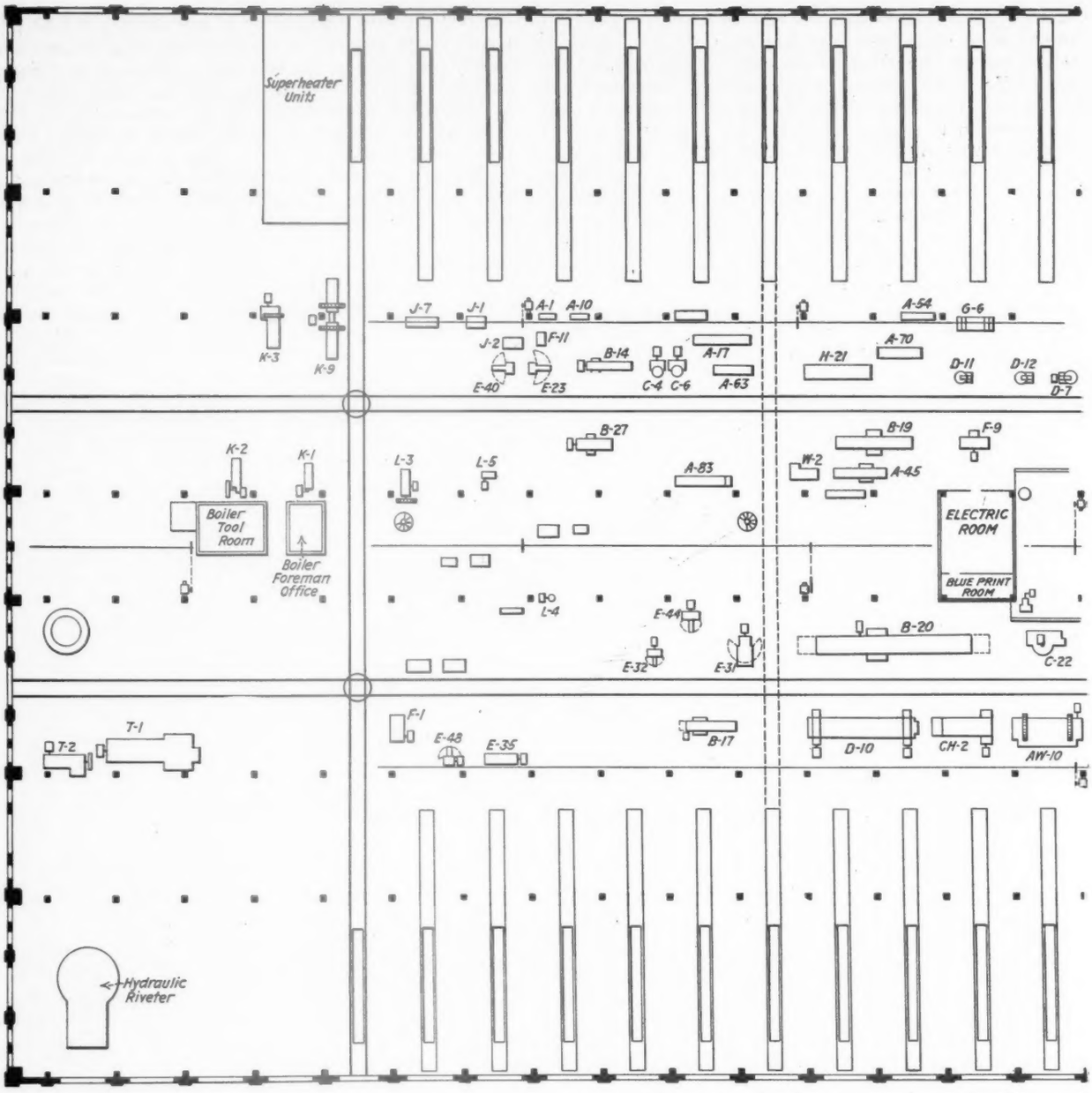
Closely associated with the organization of the maintenance-of-equipment employees at the principal shops at Sayre, Pa., is the Shop Crafts Athletic Association and also the Ladies' Auxiliary of these combined associations.

Located in practically the center of the shop plant is a meeting place for the employees' organizations, known as Assembly Hall. The shop crafts organization wanted to have a meeting place; it seemed desirable to have it on company property convenient to the various departments. The old cab and tank shop, which had been used for emergency purposes during the strike and is centrally located, was available, but it was hardly adapted for a social center or meeting hall. President Loomis indicated that this building would be placed at the disposal of the employees and that material would be furnished for remodeling it and putting it into good shape, if the men would do the work on their own time.

The men went at the task with enthusiasm and energy and were supported by the Ladies' Auxiliary, which had a large part in arranging for the decorations and the finishing touches and giving the whole building a homelike appearance. It is 173 ft. long and 75 ft. wide and is divided into two parts, one a combination auditorium and dancing hall and the other a cafeteria and game room in which pool tables and three bowling alleys have been installed. A maple floor was built over the old concrete floor. The roof girders are concealed by tastefully arranged bunting. A stage with the necessary dressing rooms, has been placed at one end of the hall, the employees purchasing the scenery and properties. The walls were decorated and the windows have been tastefully draped with curtains.

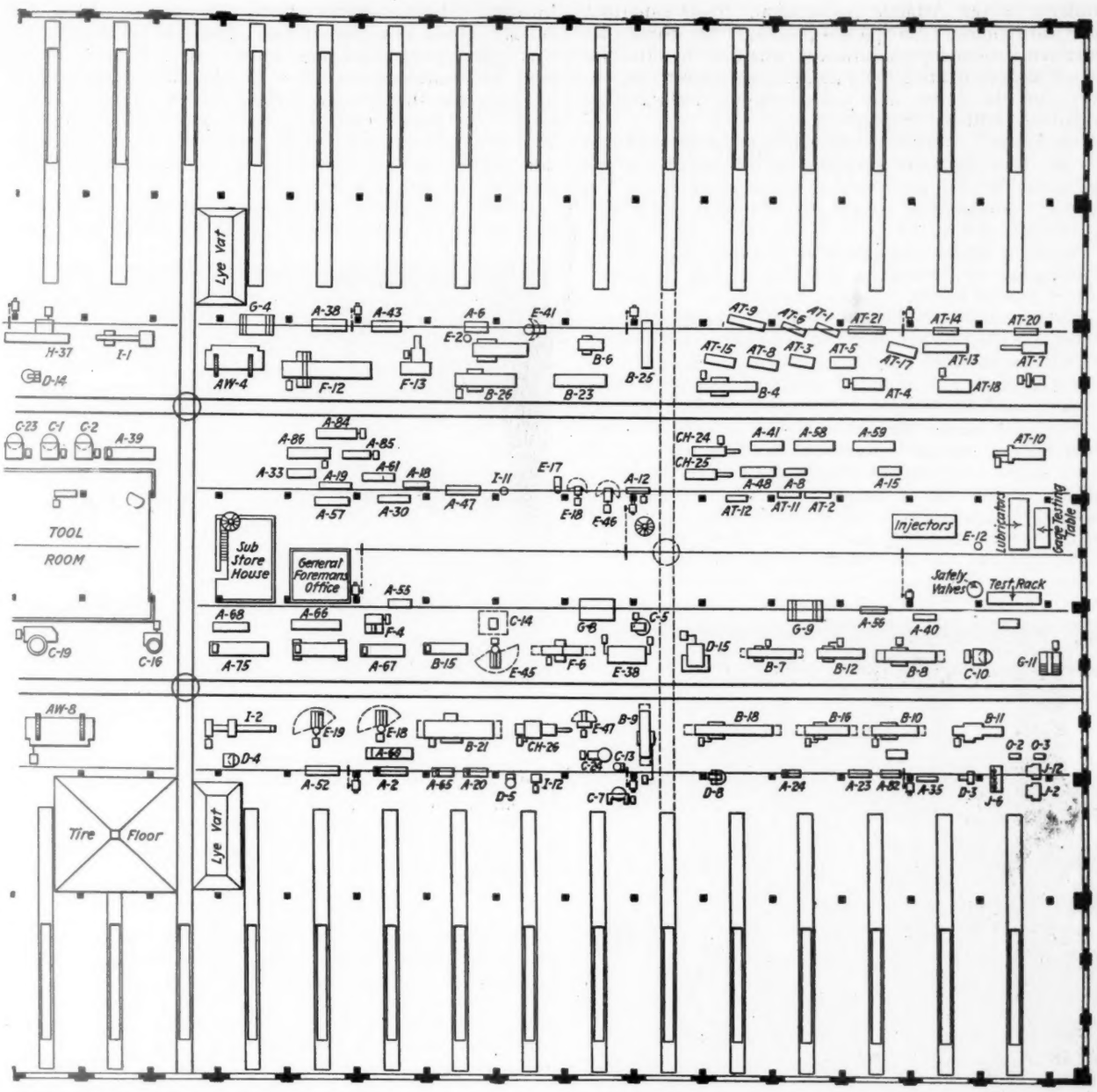
To some extent this hall is the social center of the city of Sayre, which has a population of slightly over 8,000. Dances are held every week and vaudeville shows and other entertainments are put on by the employees and their families at more or less regular intervals. A considerable amount of high grade local talent is available. An orchestra and a band composed of shop employees furnish music and are so well organized and proficient that they occasionally schedule programs of their own. Athletic events, at least to the extent of wrestling and boxing, are also put on occasionally. A charity ball, held under the auspices of the Maintenance of Equipment Association, netted $1,200 clear for the Robert Packer Hospital at Sayre. A Christmas entertainment was furnished for the children of the community and the association also took care of a number of needy families.

At various places on the walls of the auditorium are photographs of the officers of the association and of the Ladies' Auxiliary, of the band and the orchestra. But there is one set of photographs which is highly prized. It includes individual photographs of the officers of the road and some of the board of directors. These photographs mean something. The directors, on their annual inspection trip, spent an evening at Sayre and were en-



Floor plan showing the location of machine tools

Tool Ref. No.	Machine Tool
T-2	7-ft. 8-in. bending rolls
T-1	4-ft. 6-in. bending rolls
K-2	24-in. punch
K-1	42-in. punch
K-3	72-in. punch
K-9	1½-in. combination punch and shear
L-3	72-in. roller shears
L-5	3/16-in. tin shears
L-4	Roller shears
B-27	32-in. planer
B-17	48-in. planer
B-14	48-in. planer
C-4	42-in. vertical boring mill
C-6	42-in. vertical boring mill
E-48	72-in. radial drill
E-35	4-in. vertical drill
E-32	72-in. Universal drill
E-31	72-in. radial drill
E-44	72-in. radial drill
E-40	60-in. radial drill
E-23	60-in. radial drill
F-11	10-in. milling machine
J-7	4-spindle staybolt machine
J-1	2-in. bolt cutter
J-2	2½-in. bolt cutter
A-1	14-in. lathe
A-10	16-in. lathe
A-17	30-in lathe
A-63	30-in. lathe
A-83	30-in. lathe
H-21	20-in. piston grinder
W-2	36-in. saw
A-54	24-in. lathe
A-70	42-in. lathe
B-19	60-in. planer
A-45	24-in lathe
B-20	72-in. planer
D-10	24-in. duplex slotter
G-6	18-in. shaper
D-11	24-in. slotter
D-12	18-in. slotter
D-7	18-in. slotter
F-9	No. 4 milling machine
C-22	96-in. vertical boring mill
CH-2	90-in. quartering machine
AW-10	90-in. wheel lathe
AW-8	100-in. wheel lathe
H-37	Guide grinder
I-1	400-ton wheel press
D-14	14-in. slotter
C-23	42-in. vertical boring mill
C-1	42-in. vertical boring mill
C-2	42-in. vertical boring mill
A-39	Lathe
C-19	84-in. vertical boring mill
C-16	72-in. vertical boring mill
G-4	16-in. shaper
AW-4	90-in. wheel lathe
A-38	22-in. lathe
A-43	24-in. lathe
F-12	58-in. by 16-in. horizontal milling machine
F-13	58-in. vertical miller
A-6	16-in. lathe
E-2	12-in. vertical upright drill
B-5	36-in. planer
K-5	36-in. planer
B-26	36-in. planer
B-6	36-in. planer
B-23	56-in planer
B-25	36-in. planer
E-41	72-in. radial drill
A-84	19-in. lathe
A-85	20-in. by 12-ft. engine lathe
A-86	20-in. by 12-ft. engine lathe
A-33	20-in. lathe
A-19	19-in. lathe
A-61	30-in. lathe
A-18	18-in. lathe
A-47	24-in. lathe
A-30	20-in. lathe
A-57	24-in. lathe
A-68	36-in. lathe
A-66	36-in. lathe
A-75	36-in. lathe



and shop equipment in the locomotive shop

Tool Ref. No.	Machine Tool
A-67	36-in. lathe
A-55	24-in. lathe
F-4	48-in. milling machine
B-15	48-in. planer
I-11	50-ton hydraulic flange clamp
E-17	48-in. Universal drill
E-18	72-in. radial drill
E-46	72-in. radial drill
A-12	18-in. lathe
C-14	52-in. vertical boring mill
E-45	72-in. radial drill
G-8	18-in. shaper
C-5	51-in. vertical boring mill
F-6	48-in. milling machine
E-38	2 spindle vertical upright drill
I-2	500-ton wheel press
D-4	14-in. slotter
E-19	72-in. radial drill
A-52	24-in. lathe
E-18	72-in. radial drill
A-60	30-in. lathe
A-2	Special lathe
B-21	72-in. planer
A-65	34-in. lathe
A-20	18-in. lathe
D-5	14-in. slotter
CH-26	Cylinder boring mill
I-12	100-ton hydraulic press

Tool Ref. No.	Machine Tool
E-47	72-in. radial drill
B-9	36-in. planer
C-7	42-in. vertical boring mill
C-24	vertical boring mill
C-13	52-in. vertical boring mill
AT-9	4¼-in. automatic turret lathe
AT-6	2-in. automatic turret lathe
AT-1	1-in. automatic turret lathe
AT-21	1½-in. turret lathe
AT-14	2-in. automatic turret lathe
AT-20	1½-in. turret lathe
AT-15	4¼-in. turret lathe
AT-8	4¼-in. automatic turret lathe
AT-3	2-in. automatic turret lathe
AT-5	3-in. automatic turret lathe
AT-13	2-in. automatic turret lathe
AT-7	4¼-in. automatic turret lathe
B-4	36-in. planer
AT-4	2-in. automatic turret lathe
AT-18	6-in. turret lathe
CH-24	24-in. horizontal boring mill
CH-25	24-in. horizontal boring mill
A-41	24-in. lathe
A-58	24-in. lathe
A-59	30-in. lathe
A-48	24-in. lathe
A-8	16-in. lathe
A-15	18-in. lathe

Tool Ref. No.	Machine Tool
AT-10	6-in. automatic turret lathe
AT-12	16-in. automatic turret lathe
AT-11	16-in. automatic turret lathe
AT-2	16-in. automatic turret lathe
E-12	36-in. vertical upright drill
D-15	18-in. slotter
B-7	36-in. planer
G-9	18-in. shaper
A-56	26-in. lathe
A-40	24-in. lathe
B-12	45-in. planer
B-8	36-in. planer
C-10	52-in. vertical boring mill
G-11	36-in. shaper
B-18	60-in. planer
B-16	48-in. planer
B-10	36-in. planer
B-11	36-in. planer
O-2	8-in. staybolt centering machine
O-3	2-in. centering machine
J-12	3 spindle staybolt machine
J-2	2½-in. bolt cutter
J-6	4 spindle staybolt machine
D-3	14-in. slotter
A-35	20-in. lathe
A-82	8-in. lathe
A-23	18-in. lathe
A-24	20-in. lathe
D-8	18-in. slotter

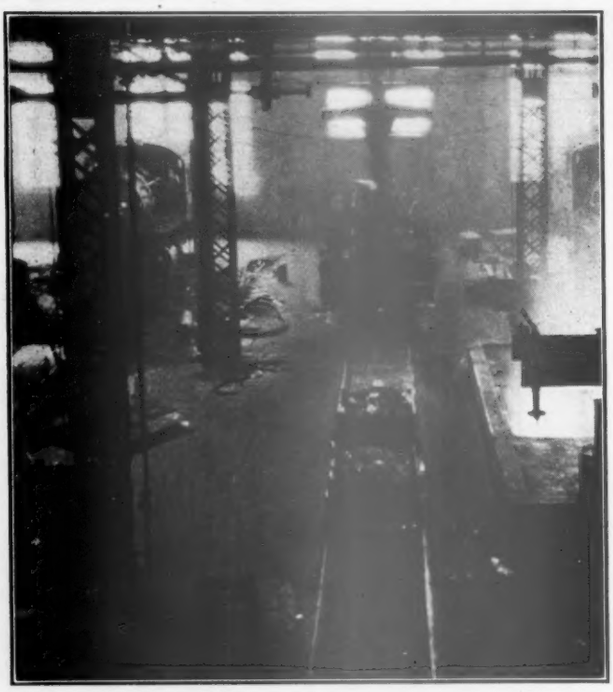
tertained by the Athletic Association. It is said that there were almost 1,800 people present. The thing that impressed the employees, however, was that the directors did not disappear after the vaudeville entertainment, but stayed for the dance, and had a splendid time getting acquainted with the employees.

The Ladies' Auxiliary has 1,132 members and not only has been intensely interested in helping to improve the Assembly Hall and develop a fine social spirit, but has been influential in boosting the railroad and soliciting business for it.

The shop crafts employees do not pay dues to the Maintenance of Equipment Association, but do pay 25 cents a month to the Athletic Association. The dues, supplemented by the proceeds from special entertainments, are used to maintain the Assembly Hall and for charitable and other purposes.

The band, as well as the orchestra and shop quartette, are very much in demand in Sayre and nearby communities. Last summer the band offered to put on a program free of charge for any of the churches in Sayre which might desire to use this form of entertainment in raising funds. All of the churches took advantage of the offer, and, as a result, there has developed a splendid spirit of understanding and co-operation between the shop employees and the community as a whole.

The social activities of the shop crafts at Sayre are



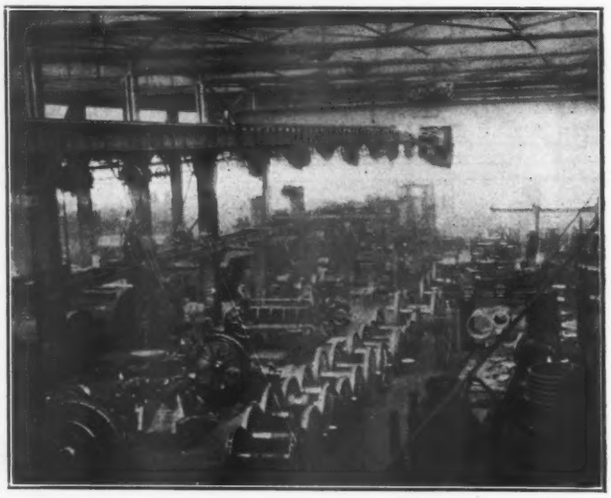
The lye vats are located adjacent to the incoming track, from which the locomotive parts are routed to the different departments

being duplicated to some extent at Easton, Leighton, Coxton, and Ashmore, Pa., Buffalo, and Auburn, N. Y., and other points. The management is glad to co-operate to the fullest extent wherever the men show a sufficient interest to promote such activities.

The cafeteria

A few of the shop employees at Sayre can go home for lunch at noon. Most of them, however, formerly carried lunches. Some of them wanted a hot meal and so a cafeteria has been established in the Assembly Hall by the Athletic Association on a co-operative basis to furnish meals at or near cost. The Ladies' Auxiliary was given general supervision and Mrs. Thomas Holland, its chairman, was asked to take direct charge. A manager was then hired and the cafeteria is now serving about 250 meals each noon. Any of the men are welcome to bring their lunch boxes into the dining hall and, if they so desire, can purchase hot coffee or supplement their lunch in other ways.

Another interesting development has been 10-minute educational and inspirational talks in the dining hall dur-



Efficient crane service in the machine shop, especially for wheel repairs, is an important factor in the production work at Sayre

ing the lunch hour. Various officers and others are invited to give these talks, most of them relating to the railroad and its operation or to matters of special interest to the employees.

Foreman training

The study made by the *Railway Mechanical Engineer* in 1925 showed that the Lehigh Valley had approached the problem of foreman training somewhat differently from other roads and that the mechanical department at Sayre was going at the task in a methodical and most effective manner. A brief description of the foreman training work at Sayre was published in the June, 1926, issue of the *Railway Mechanical Engineer,* page 336. The foremen meet in the apprentice school room, which is located in a building between the storehouse and main office building and the blacksmith shop. The class is in charge of the apprentice instructor, which includes 51 foremen, gang leaders, etc.

A better understanding on the part of the foremen of the way in which to lead their men and of their relations with their fellows and to the management, naturally is a great help in developing and maintaining the right sort of contacts between the men and the higher officers. It keeps open the channels which make it possible for the management to be more responsive to the needs of the men; it also keeps the men better posted as to the problems of management and the condition of the property.

Dealing with the public

The relations of a railroad to the public and its relations to its employees are closely interwoven. The employees in some cases, such as Sayre, form a considerable part of communities which are served by the railroad. In educating the community as to the facts about the

railroad it will at the same time reach the employees. On the other hand, the employees, if they are keenly interested in the railroad's welfare, can be an important factor in "selling" the railroad to the community. It is interesting to note how the employees, of their own volition, are taking a hand in the matter. Reference has already been made to the fact that the Ladies' Auxiliary of the shop crafts organization at Sayre has been active in boosting the road and soliciting business for it. A fair example of this is a pamphlet entitled, "Steady Employment on the Lehigh Valley," which was distributed by the Maintenance of Equipment Association and Athletic Association at the Sayre shops. It reads as follows:

To Fellow Employees:

The first step in our campaign to keep L.V.R.R. employees steadily at work was a letter to all shippers and receivers of goods in this vicinity, urging them to use L.V.R.R. lines as much as possible in all their movements of freight.

The next step is squarely up to every man employed by the L.V.R.R. for "The Lord helps those that help themselves." You can be of great assistance in keeping yourself and fellow employees at work if you will earnestly strive to carry out the following suggestions:

1—Be loyal to the Lehigh Valley, not only in your work, but by telling of its unexcelled service and advantages to all travelers and shippers whom you meet.

2—Buy your coal, food and merchandise from those who ship and receive freight over the Lehigh Valley.

3—Urge your friends to patronize the merchants and business men who ship via Lehigh Valley.

4—Tell your merchants that over one-half of the freight charges they pay are paid out in wages and so benefit them.

5—Be saving in your work and time. Efficient labor and careful use of material means more money for the company to spend on the great amount of work always waiting to be done.

Your co-operation in carrying out these suggestions will insure steady employment and prosperous conditions for all.

The result of these activities on the part of the management and the employees has borne much fruit in developing a more cordial spirit between the public and the Lehigh Valley, and it has had a splendid reaction upon the relations of the employees with the management.

Both locomotive and wooden car repairs are handled at Sayre

The locomotive shops at Sayre perform practically all of the classified repairs on the 941 locomotives owned and operated by the Lehigh Valley. In addition, the car shop, which is located to the left of the power house, handles all the heavy repair work on freight and milk cars, refrigerator cars and cabooses, owned by the company. Both the car and locomotive shops are under the jurisdiction of the shop superintendent and the same plan of personnel organization is applied to both departments.

The locomotive shop building has a total of 52 pits and houses the machine shop, erecting shop, boiler and cab departments. It is 336 ft. wide by 740 ft. long. The pits are arranged transversely, 26 pits on each side with the various machine departments located along the center of the building. All departments are provided with adequate overhead traveling crane service, the two erecting shops being served with two 220-ton cranes for handling locomotives from the incoming track to the pit. In addition, 11 overhead traveling cranes are provided for handling material in the various departments located in the locomotive shop building.

Location of departments facilitates the work

Referring to the drawing showing the location of the shop tracks and buildings, locomotives to be repaired are taken into the shop via the turntable located to the northeast side of the building. A view of the turntable and tracks leading to it is shown in one of the illustrations. The track leading from the turntable into the locomotive shop extends past the lye vats, which are located on both sides of the building, as shown in the floor plan drawing. Incoming locomotives are moved by overhead traveling cranes from the incoming track to the pit to which they are assigned.

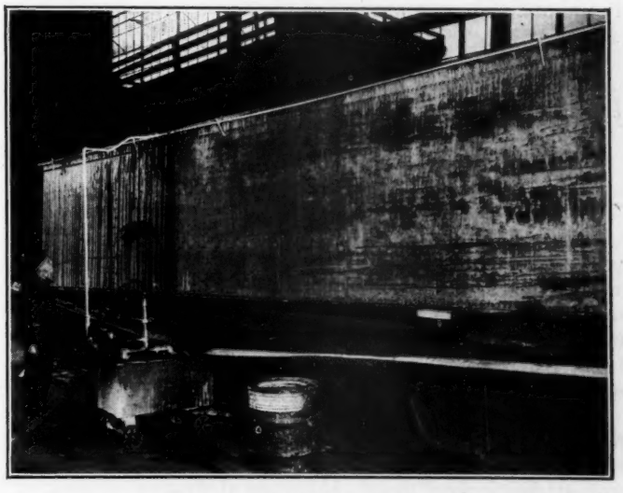
Five helpers and laborers, under the supervision of a mechanic, do all the stripping for 24 pits. This work includes stripping the locomotive, placing the parts to be cleaned in the lye vat and delivering them to the various departments in the machine shop. In stripping the locomotives, the rods are taken down first, pedestal binders removed, the locomotive raised and the wheels moved forward into the short bay between the erecting and machine bays. All locomotive parts are moved to the front, placed in a basket and taken to the lye vat.

Special effort is made to see that the cranes are not used any longer than necessary for this work. If the motion work, for example, has not been entirely taken down, the crane is released and a trip to the lye vat with these parts is made later. The location of the erecting shops on both sides of the locomotive shop building and the machine shop departments between the two greatly facilitate the work of routing and handling material. Locomotive parts are routed from the lye vat directly to the proper departments where they are inspected by the foreman or his representative.

(The concluding installment of this article will appear in the December issue. It will include a description of the scheduling system used in handling locomotive repairs and also descriptions of many of the detail operations and some of the shop kinks and fixtures that have been developed by the employees.—Editor.)

Stripping paint from locomotive tenders

ONE of the most recent methods of stripping paint from locomotive tenders is shown in the accompanying illustrations. A small portable tank, heated by steam, is connected to a long pipe which is clamped to the

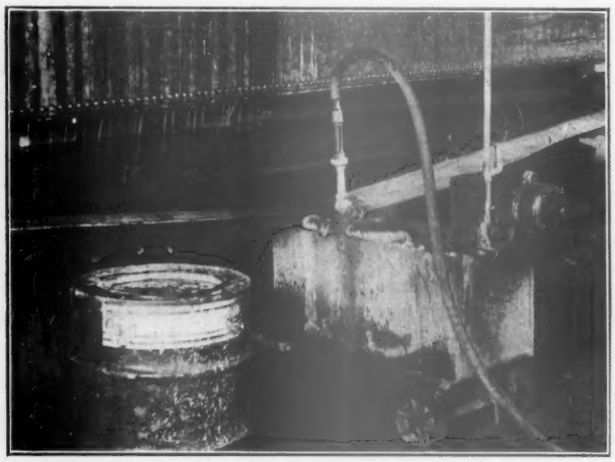


Equipment in place for stripping the paint from a locomotive tender

side of the tender and in which there are a series of ⅛-in. holes. A small motor is attached to the portable tank to provide sufficient pressure to pump the paint removing solution up into the pipe on the tender. The pressure need only be sufficient to make the solution pour out onto

the side of the painted surface. A trough is located under the lower edge of the tender side to catch the cleaning solution and convey it back to the solution tank. In this manner the solution is reclaimed and can be repeatedly reused.

An interesting part of this work is the question of cost. It has been the practice on most railroads to remove the paint from tenders about every six or seven years. Experienced railroad men feel that the painted surfaces should be stripped every three years and painted yearly. The reason why some such schedule has not been put into effect is because of the excessive costs. By using



A closer view of the tank, the motor and troughs by means of which the solution is reclaimed

varnish remover it requires about $25 of labor and material to strip an 8,000-gal. tender, including the coping. With paint removing solutions and the method used as shown in the illustrations, an 8,000-gal. tender was stripped in 11½ hr. using about 150 lb. of materials. This particular job was particularly difficult. With properly designed equipment and an ordinarily difficult piece of work to do, the time could be cut to about eight hours and the consumption of materials to approximately 50 lb.

Loading cinders from locomotive ashpits

THE device shown in the accompanying illustration facilitates the removal of cinders from small locomotive ashpits. A pit is dug beneath the track and lined with concrete walls. This excavation extends a few feet out beside the track. A small dump car built in a diagonal position the elevated end of which terminates over the loading track passes through the opening alongside of the ashpit.

The dump car is made up of two small trucks with flanged wheels that run on the diagonal track which is made of discarded rails. The rectangular body of the car, made of sheet metal, holds the discharge of four or five locomotives. One half of the bottom or floor of the car body is loose and hinged at the lower corner with heavy strap hinges. Near the center of the car bottom and attached to the drop lid or shutter is another wheel that runs on a center rail between the two forming the main part of the track. This center rail extends to a few inches past the edge of the gondola cars into which the cinders are loaded, where it curves downward. The car is lowered into the pit until several engines have been cleaned, the cinders dropping down into it between the rails. A gasoline engine drives a drum on which a cable winds on the opposite side of the gondola being loaded, by which the cinder car is drawn up the diagonal track until the wheel under the center comes to the downward curve in the center rail, where it rolls

A simple device for loading cinders from an ashpit where an overhead crane is not available

over the curve and drops down, allowing the hinged half of the car bottom to drop, releasing the load into the gondola. The hinged half of the bottom is the half next to the cinder pit track, and because of the slanting position of the other half of the bottom, the cinders slide out without attention.

Interior view of the blacksmith shop of the American Locomotive Company, Schenectady, N. Y.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

A question of three-cylinder valve motion patents

NEW YORK, N. Y.

TO THE EDITOR:

Referring to the article by Jack Britton in the August issue of the RAILWAY MECHANICAL ENGINEER, entitled "Setting valves of three-cylinder locomotives," Mr. Britton gives credit to H. N. Gresley for the invention of a system of levers whereby the valve for the inside cylinder of a three-cylinder locomotive derives its motion from the movements of the valves of the two outside cylinders.

Mr. Britton is not the first to overlook the fact that this system of valve gear is the invention of the writer, to whom United States patent No. 946,083 was issued on January 11, 1910, covering broadly the operation of a central valve of a three-cylinder locomotive by the combined movements of the two outer valves.

About five years later, Mr. Gresley applied this principle to some three-cylinder locomotives built by him for the London & North Eastern Railway and on November 8, 1915, English Patent No. 15,769 was granted him covering his construction.

It should be stated that Mr. Gresley's method of applying the principle is slightly different from mine, his variation being used by the American Locomotive Company. However, the underlying principle is the same and the method which he uses is broadly covered by my patent.

H. S. VINCENT.

Tests of cast iron brake shoes—An opinion

SAN FRANCISCO, Cal.

TO THE EDITOR:—

Referring to my letter to the editor which was published in the August issue and Mr. Williams' reply, on the subject of comparative tests of cast iron brake shoes, I am still of the opinion that in any tests made of brake shoes, the wear of the wheel or tire should be taken into consideration. I have no doubt that with different kinds of metal in the brake shoes, different kinds of wear will appear on the tread of the wheel. For example, we recently made up for experimental purposes, some cast steel brake shoes and applied them to the driving wheels of a yard engine, in comparison with our standard brake shoes, with the result that the two tires to which the standard shoes were applied showed a reduction in diameter of .25 in. as against an average on the four wheels to which the cast steel shoes were applied of .41 in. The shoes were applied October 1, 1925, and the measurements above mentioned were taken March 9, 1926.

At the same time measurements were made of the standard shoes, and the cast steel shoes, and these showed that both kinds of shoes had worn at the top an average of 1.06 in., while the standard shoes had worn at the bottom an average of 1 in. and the cast steel shoes an average of 1.15 in.

I am merely quoting the above figures to illustrate my meaning in connection with the advisability of considering tire wear in brake shoe tests.

DENNISTOWN WOOD,
Engineer of tests, Southern Pacific.

The answer

During the past five years, inquiries made of the leading American railroads for some specific data or records showing the comparative wear of wheels with different types of brake shoes in use, indicate that the wheel wear produced by any of the various types of cast iron brake shoes is so small compared with the wear produced by the action of the rail that it is impossible to measure it.

The brake shoe testing machine at the Mahwah, N. J., plant of the American Brake Shoe Company, bears out the above in laboratory tests where small losses can be measured. This machine is similar to the testing machine at Purdue University and at the testing laboratory of the Pennsylvania at Altoona, Pa. On these machines either a steel tired or chilled cast iron wheel may be mounted on an axle and does not come in contact with the rail. After thousands of stopping tests with all kinds of brake shoes of cast iron (Diamond-S, special chilled, etc.), through a wide range of speeds from 10 to 80 m.p.h. and wide ranges of brake shoe pressures and wheel loads, the testing engineers have never been able to measure the reduction in the wheel circumference on either a steel tired or a chilled iron wheel.

The brake shoe testing machine at Mahwah, N. J., has been in almost constant use for the past 15 years in development work for the American Brake Shoe and Foundry Company, and by numerous railroads as well who have had their mechanical engineers make tests of various types of brake shoes. Wheels have been removed for one reason only during that time; viz. fatigue from repeated heating and cooling, resulting in cracked treads. When measured, these wheels have not shown any reduction in circumference.

It is practically impossible for a brake shoe to cause any wear on a chilled iron wheel on acount of the fact that the circumference of a 33-in. wheel is about 104 in.. while the length of a brake shoe is only 13¾ in. Of this 13¾ in. only about 2½ in. at each end is chilled or white iron and the remainder is gray iron, while the entire circumference of a chilled iron wheel is white iron. The brake shoe becomes much hotter than the wheel because it is absorbing heat throughout its entire length during the time the brake is applied while one-seventh to one eighth of the wheel circumference is absorbing and the remainder is radiating heat. The face of the brake shoe accumulates heat almost instantly and small particles are torn off, while the wheel tread re-

mains cool and hard. During a long brake application, the brake shoes may become red hot, but the wheel heats up slowly. Chilled iron, when cold, is hard enough to turn the point of a prick punch, but when heated to 800 deg. or more, becomes soft and will not turn the point of a prick punch.

One railroad made the following test on the wear of the rolled steel wheel by the special chilled and the expanded metal insert shoes on passenger coaches with the following results:—

Special chilled type	.2166 in.
Expanded metal insert	.1551 in.

Arrangements were made to keep the best record possible of the wheel wear by measuring the circumference of the tires when the brake shoes were both applied and removed. The average losses in circumference per wheel with the two types of brake shoes were as above.

These measurements would seem to indicate that the expanded metal insert caused less wheel wear than the special chilled type, but the fact of the matter is that the reduction in circumference is so small that the error in measurement with a steel tape would account for the difference. It is safe to say that the reduction in wheel circumference was actually the same under both shoes, as a difference of .06 in. is too small a quantity to determine with a steel tape on a wheel of 104 in. or more in circumference.

From the above results, it is practically certain that the entire reduction is due to the rolling of the steel wheel on the rails. This can readily be checked by examining a wheel in service and noting the location of the wear. It will be seen that the brake shoe plays very little part in the wear of the wheel.

Fred H. Williams,
Assistant test engineer, Canadian National.

Car wheel grinding advocated

St. Paul, Minn.

To the editor:

The editorial, "Car Wheel grinding advocated," published in the June 16, 1926, issue of the *Railway Age Daily Edition,* recalls some observations I made when, as chairman of the committee, I was preparing the paper on slid flat wheels which was presented before the 1895 convention of the Air Brake Association. At that time I noted how eccentric wheels apparently contributed to wheel sliding. This was further confirmed later by special checks of slid flat wheels on three different railways where they did not grind their old wheels. On one road the check disclosed that an old wheel boring machine was turning out as eccentric wheels most of its product, which resulted in the machine being scrapped. Following is an abstract of the germain paragraphs of that report which may be helpful to your readers:

"Then, too, where wheels are out of round or not centrally bored, there must generally be a tendency at each revolution to force the brake beam farther from the center of the axle, which would be equivalent to an increased shoe pressure. Some railway companies grind all cast-iron wheels after they are mounted and at least one manufacturer rough bores and grinds one make of wheel before sending it to the user.

"Reports from a few roads using wheels which have undergone one or the other method indicates the undoubted advantage in preventing wheel sliding. It has been noted by a member of this committee that in the shops of a road which makes a practice of grinding flat wheels which are not too bad, such wheels are frequently out of round and flat spots are located on the part of the tread that would be in contact with the rail when the greatest diameter of the wheel was about under the brake shoe.

"It is reasonable to assume that this trouble would exist the least where grinding new wheels is practiced because of indicating all such defects and tending to their prevention in casting and boring."

F. B. Farmer,
Northwestern representative, Westinghouse Air Brake Company.

Another method of making spring bands

Waycross, Ga.

To the editor:

In glancing through the March issue of the *Railway Mechanical Engineer,* page 176, I noticed some views and sketches of solid spring bushings and bands. I have been engaged in this class of work for years, during the course of which I have worked out a method of manufacture which I believe is much quicker and easier than the method described in your March issue.

On the Atlantic Coast Line we do just the opposite from what is described in the article referred to, which primarily consists of stretching by punches. We draw the material in a mandrel over a bridge tool. In determining the amount of material for a band we figure the weight of the outside diameter of the band, weight of inside diameter, subtract one from the other, and add to the remainder the weight of the material which is punched from the hole. Suppose we are to forge a band with a 14-in. outside diameter, a 10-in. inside diameter and an 11-in. face. The calculations are made in the following manner:

14-in.	round	steel	weighs	$43.62 \times 11 = 479.82$ lb.
10-in.	round	steel	weighs	$22.65 \times 11 = 244.75$ lb.
			Actual weight of band	235.07 lb.
4-in.	round	steel	weighs	$3.57 \times 11 =$ 39.27 lb.
			Weight of band plus weight of steel removed from 4-in. hole	274.32 lb.

Thus, to obtain the proper size billet to make the band with the above dimensions, we figure as follows:

9-in. round steel weighs $18.02 \times 15\frac{1}{4} = 274.80$ lb.

The proper size billet is cut off to length from a 9-in. axle, knocked down on a hammer to within 1 in. of the proper thickness after which the holes are punched. It is then ready to go on the bridge tool to be stretched.

Two mandrels are used, one 3½ in. round and the other of whatever size radius the band happens to measure. The band is first stretched almost to size in the small mandrel after which it is put on the second mandrel. All this is done in one heat which is much faster, requires less work and less tools, and gives greater quantity and better quality. It also eliminates all the unnecessary work of lifting up and down.

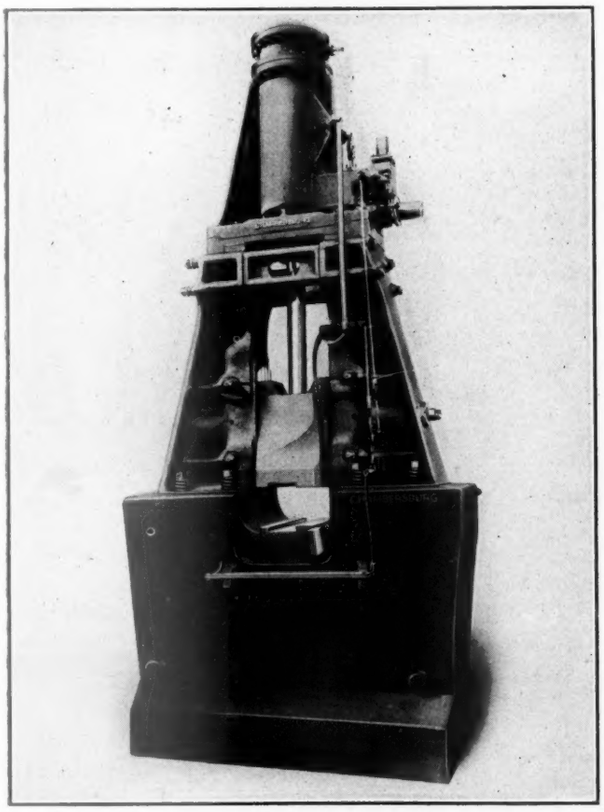
By this method the bands can be made according to calculations, thus eliminating all guess work. If the weight is figured correctly and care is taken in cutting off the billet, the band will be the right size and also have a square edge.

The other method will work all right for narrow bands, but how about a band with a 10-in. face? Most of our bands average from 7 in. to 12 in. wide, 14¾ in. outside diameter and 12 in. inside diameter, which would be almost impossible to manufacture by the other method.

W. W. Sharkford, Jr.

Chambersburg type B steam drop hammer

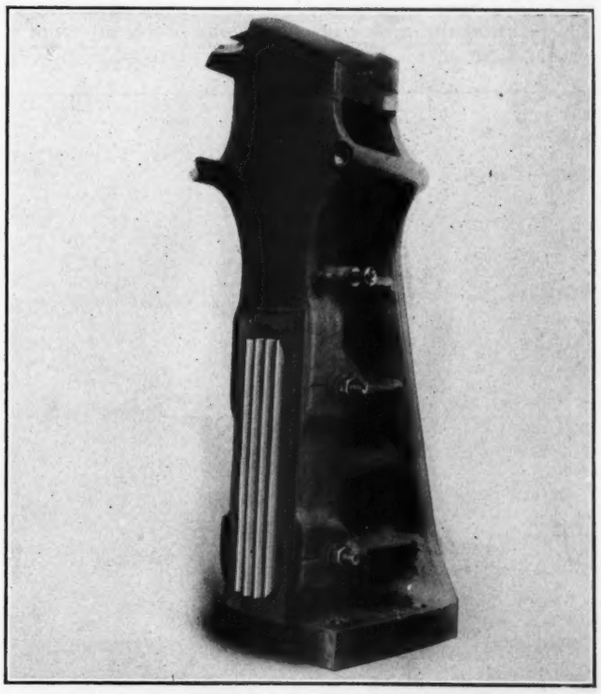
THE Chambersburg Type B steam drop hammer, the 12,000 lb. size of which is illustrated, has recently been placed on the market by the Chambersburg Engineering Company, Chambersburg, Pa. The hammer embodies several improvements to insure the permanency of alinement and decreased operating and maintenance costs.



The 12,000-lb. Chambersburg Type B steam drop hammer

The anvil has been redesigned so that all sharp corners are eliminated, and large fillets are provided throughout the frame seats. The wearing wedge is installed to take up wear between the frames and the anvil. The seats of the frames have been raised to a point approximating the dividing line of the dies, so as to decrease materially the tendency of the frames to rock. The frame to anvil bolts have been provided with keyed heads in the anvil, which are located above the floor line and are, therefore, readily accessible. Cores below the sow block have been eliminated, and the wedges and bolts nearest the sow are inserted in holes bored from the solid metal.

The bearing surfaces on the bottoms of all the frames have been increased by extending the frames from left to right. Where single tie bars are standard, the tie bar has been dropped below the top of the frame, to secure greater strength and effectiveness. The frames are tongued to the interlocking tie plate at the top.



Detail assembly of the frame and the tie plate

The cylinder follows the standard Chambersburg self-draining design and, in addition, is provided with a removable liner which provides for renewals.

The interlocking tie plate has been designed to elim-

inate any overhanging, thereby reducing the hazard of breakage. This tie plate is dove-tailed in both directions to the frames, fixing them in alinement, and is counterbored in its center to receive an extension from the throat of the cylinder, providing for the maintenance of the cylinder alinement. The ends of the tie plate are also lipped to the base of the cylinder which was described in the preceeding paragraph.

The guides have been redesigned to be invertible, as well as interchangeable, and guide adjusting bolts have been provided with ratchets to lock them in position. The cam mechanism has been redesigned to eliminate all square ends and keys. The cam and its arm are forged from the solid. The valve rocker bearing is bronze bushed.

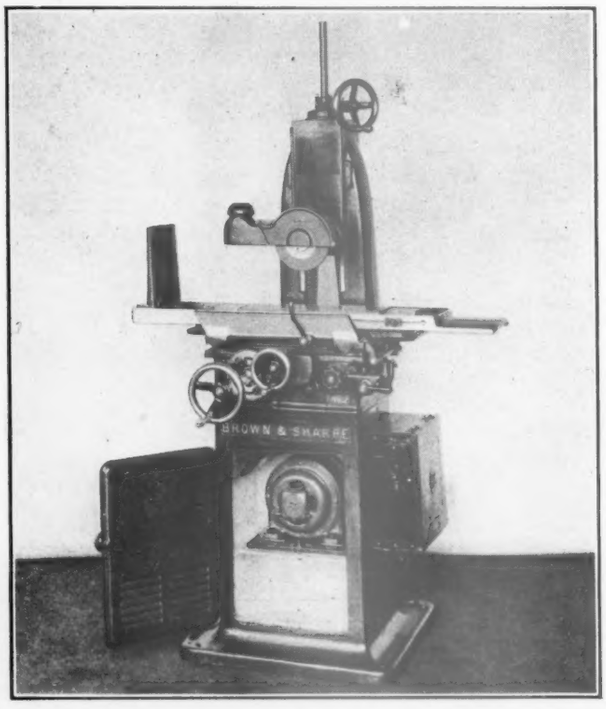
In designing the Type B steam drop hammer, studs have been eliminated, as far as possible, in favor of through bolts, with the result that the only studs used are some of the packing gland studs, and those cylinder cover studs over the steam ports.

Hot forged steel unions

STEEL unions forged hot from solid steel bars and suitable for steam, hot and cold water, gas, oil and air service, are being manufactured by the Central Forging Company, Catawissa, Pa. Since the unions are made of the same material as the pipe to which they are attached, they will have the same expansion and contraction. They can be furnished with seats steel to steel, bronze to steel and monel metal to steel, all of which are locked in place. They are recommended for hydraulic pressures, cold test, up to 6,000 lb. per sq. in., and when fitted with monel metal seats for the highest pressures and temperature at which steam is used.

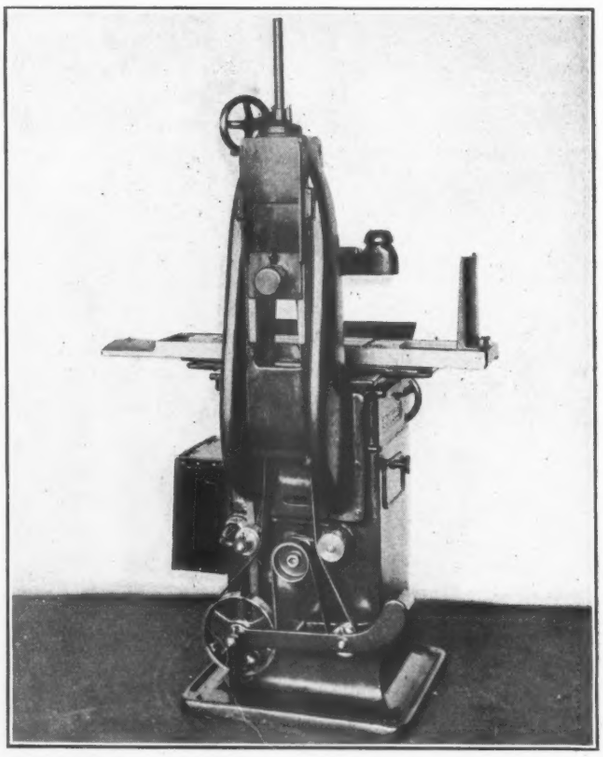
B. & S. surface grinding machine

THE latest addition to the line of complete-unit machine tools manufactured by the Brown & Sharpe Manufacturing Company, Providence, R. I., is the No. 2 surface grinding machine, which has the motor enclosed within the base of the machine. In this position the motor is completely protected from oil, water, dust, dirt and other sources of trouble to which motors located on brackets outside of the machines are sometimes subjected.



The motor is mounted in the base of the machine with ample space beneath for storing machine attachments or tools

The motor, which is of the constant speed type, is securely mounted on a plate which is in turn bolted to a shelf in an oil-tight compartment in the machine base. Ventilators cast in the door provide sufficient circulation of air to insure a cool-running motor. Additional space is furnished under the motor shelf for storage of attachments and machine accessories. An option of several makes of motors for either direct or alternating current is given. Power is transmitted by belt. A tightener auto-



A rear view of the Brown & Sharpe No. 2 surface grinder, showing the automatic belt tightener

matically keeps the belt at the proper tension regardless of the height of the spindle head. The control box is located on the side of the base with the push-button control in a convenient operating position.

The longitudinal travel and the transverse movements of the table are automatic, the latter being provided with an automatic stop which throws out at any desired point. A knurled knob on the front of the machine disengages the power cross feed.

Controls are conveniently centralized and all vital parts are completely covered with guards which serve to protect them from destructive abrasive dust.

The machine accommodates work up to 18 in. long, 6 in. wide and 9½ in. high, when a wheel 7 in. in diameter is used. A floor space of 65-in. by 30-in. is required for the machine which weighs net, without the motor, 1,350 lb.

The attachments furnished as extras for this machine are the exhaust arrangement, which draws the dust away from the machine through the wheel guard and a telescoping pipe and discharges it into a settling pan; the wet grinding attachment, which consists of supply tank, centrifugal pump, work hood and splash guards; a magnetic chuck, and 4¾-in. index centers.

Portable motor-driven universal saw

A PORTABLE floor type universal saw which combines all of the advantages of the portable bench machine with the additional advantage of having a rigid cast iron pedestal in place of the ordinary work bench, has been placed on the market by the Gallmeyer & Livingston Company, Grand Rapids, Mich. This pedestal provides not only a convenient operating position when the saw is in use, but a convenient means of moving it out of the way when not needed. Two rollers at the back and two stationary feet at the front of the base give a firm setting on the floor when in operation. When the handle is pulled forward in a position for moving the machine, a cam automatically raises the feet from the floor and brings the weight of the front of the machine onto a third roller which is carried on a swivel bearing moving with the handle shown in both of the illustrations.

The saw blade can be raised and lowered from flush with the table to 2½ in. above the table

The motor and all working parts are built into the upper portion of the machine so as to afford a thoroughly self-contained outfit. The upper part of the machine can be removed from the pedestal and used as a bench type should occasion demand.

The machine can be supplied with either a ½-hp. repulsion induction type motor to operate from a lamp socket or with a 1-hp. repulsion induction-type motor to operate from the power line. When equipped with a power line motor and 8-in. diameter saw, will handle stock up to 12 in. wide by 2½ in. thick. The repulsion induction type motor is belted to the saw arbor.

The table is a solid, one piece casting, 25 in. by 26 in. fitted with a removable throat plate to allow for the use of dado heads, cope heads, grooving saws, etc. The saw can be raised and lowered from flush with the table to 2½ in. above the table, making it possible to cut 2½-in. stock. The table tilts up to 45 deg. and can be instantly locked at any desired setting as shown in one of the illustrations.

The 8-in. saw is properly guarded at all times and a splitter guard is also a part of the safety equipment. A switch for starting and stopping the machine is conveniently placed on the front of the machine so that there can be no temptation to let the machine run when not needed. The machine can be shut down between pieces, thus saving power.

The table of the Union portable universal saw tilted to a 45-deg. angle

The cross-cut gage can be used on either side of the saw as two planed slots, one on either side of the table are for this purpose. This gage can be quickly set at any angle and clamped rigidly in position for cutting off at any desired angle. Holes are provided for mount-

ing an auxiliary wood face piece when such action is desired.

The ripping gage is machined on both sides and can also be used on either side of the saw. The tightening of the lever head screws locks the ripping gage in position and, automatically lines it up with the saw.

Superior 10-in. bench drill

THE Type M bench drill manufactured by the Superior Machine Tool Company, Kokomo, Ind., has been especially designed for those shops in which light accurate drilling is required. The bottom cone bracket can be reversed to place the belt shifter on either side of the machine so that the driving belt can be either run from overhead or from under the bench or stand.

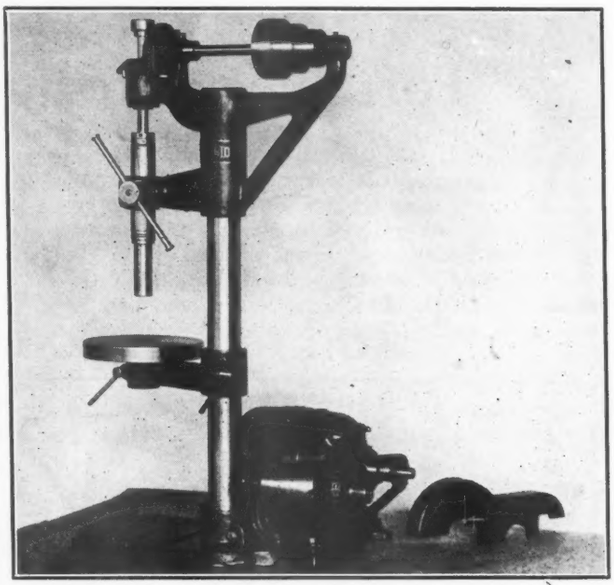
The drive can be furnished with regular tight and loose pulley, or geared motor drive. When furnished with the geared motor drive, the motor and the drill base are cast integral and the motor is mounted at the side of the machine at the rear. This shortens the length of the machine so that it can be placed on an ordinary work bench.

The cone pulleys take a 1¼-in. belt and the tight and loose pulleys a 1½-in. belt.

The feed lever on the right-hand side of the machine is held in any position by a compression spring. This prevents the spindle from dropping when the hand is removed from the feed lever. On the motor-driven machine a silent chain drive is used. All the gearing is covered by guards.

The following are a few of the general specifications:

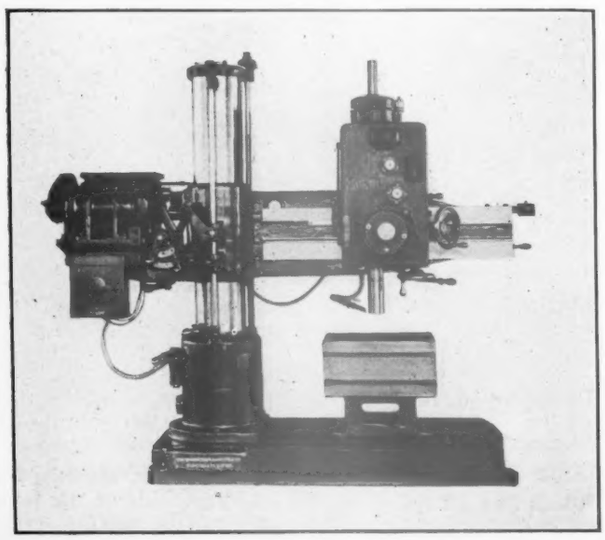
Drills, to center of	10¼ in.
Height, spindle extended	35½ in.
Takes between table and spindle	10⅞ in.
Takes between base and spindle	16 in.
Traverse of spindle	3½ in.
Traverse of table	10⅞ in.
Working surface of base	7 in. by 8 in.
Spindle bored Morse taper	No. 2
Diameter of table	8 in.
Speed of tight and loose pulleys	550 to 800 r.p.m.
Motor	1,800 r.p.m.—¼ hp.
Net weight tight and loose pulley drive	95 lb.



Superior Type M motor driven bench drill

Four-foot radial drilling machine

A FOUR-FOOT radial drilling machine with the motor and ball bearing speed box mounted on the arm has recently been placed on the market by the Morris Machine Tool Company, Court and Harriet streets, Cincinnati, Ohio. The fact that the motor is mounted on the arm eliminates four bevel gears, three speed gears and the shafts and bearings in connection with these gears which were required when the motor was mounted in the base. This method of mounting the motor also eliminates the constantly running arm raising and lowering gears on top of the column. The arm raising and lowering unit is mounted on the back of the arm and is only in operation when the arm is being raised or lowered. Either a d.c. variable speed motor or a constant speed motor and ball bearing speed box can be used.



A 4-ft. radial drilling machine with the motor and ball bearing speed box mounted on the arm

The head is fully enclosed and well balanced on the arm so that it travels freely One lever operates two clamp screws securely clamping the head on the arm without affecting the alinement. Oil is properly distributed throughout the head from an oil reservoir at the top of the head. The feed worm wheel dips in a trough of oil.

The spindle is a hammered steel forging and runs in phosphor bronze bearings in the sleeve and is driven by two keyways. The spindle is fitted with a ball thrust bearing and the spindle gear is mounted on a ball bearing. The feed unit is mounted in the head. On the 4-ft. radial there are eight feeds ranging from 5 to 42 thousandths per revolution of spindle and four thread leads: 8, 11½, 14 and 18 threads per inch.

The tapping attachment and back gear bracket is a

unit mounted on the back of the head. The tapping attachment runs in oil and its frictions are of the multiple disc type. The speed box of the sliding gear type is equipped with ball bearings which are lubricated from the splash of oil in the gear box. The driving pulley is fully enclosed and fitted with a friction clutch operated by a single lever. The drive pulley runs on ball bearings when the clutch is disengaged.

The arm is designed to resist properly torsional and lifting strains. The bearing on the column is extra long and the arm is clamped in any position by a single lever convenient to the operator. The arm is raised or lowered by a power comptroller through a lever at the bottom of the column. This lever accomplishes two purposes. It automatically unclamps the arm before the elevating or lowering gears are engaged by the first movement of the lever. A little further movement of the lever engages the gears and the arm is raised or lowered to its desired position. In bringing the lever back to its central position until the latch catches, the gears are disengaged and the arm clamped by one movement of the lever.

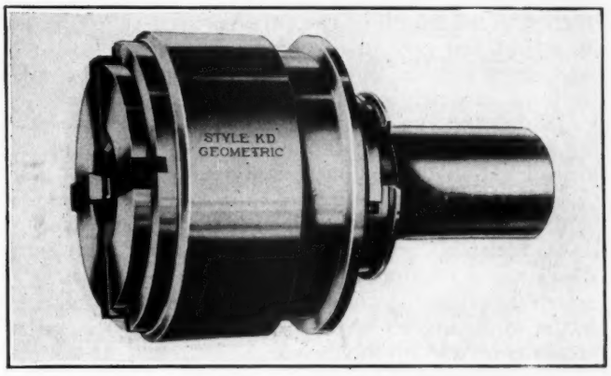
The oil channel around the base drains through a screen into a large reservoir, having an overflow partition which is provided to keep chips and dirt out of the pump.

Rotary opening die head for shoulder threading

A NEW rotary opening die head, which is said to have been developed to meet the demand for a flange trip type of head that will trip at precisely the point for which it is set, has been placed on the market by the Geometric Tool Company, New Haven, Conn.

This tool is designated as the style K-D and is adapted especially for shoulder threading. It is of small diameter, and is designed to swing on Gridley, Acme, Cone, New Britain and similar machines, also on drilling machines, threading machines and practically any live spindle. Five sizes—5/16 in., 9/16 in., 1 in., 1¼ in. and 1½ in.—are regularly available, and other sizes can be obtained to order. The chasers interchange with the company's style K heads of corresponding size.

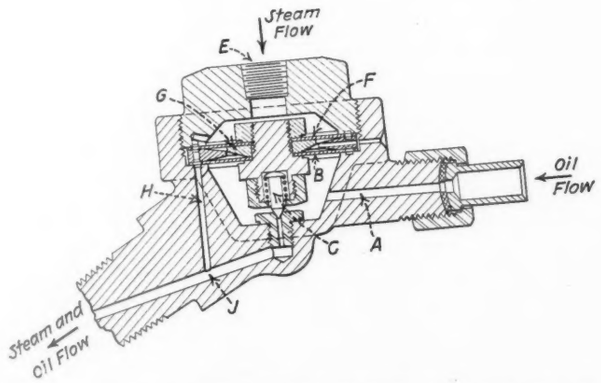
One yoke opens and closes the die head. The chasers can be removed without the use of a screw driver, by pressing down the stop lever and lifting the chasers out. The tool is hardened and ground and is completely inclosed. A grooved sleeve is provided for operation of the yoke in opening and closing the head. The chip clearance is large. The chasers extend beyond the front of the die head without overhang and are not held in place by screws.



Large chip clearance has been provided in the geometric style K-D rotary opening die head

Double diaphragm lubricator check valve

A DOUBLE diaphragm lubricator check valve for locomotive service has been developed by the Madison-Kipp Corporation, Madison, Wis., particular features of the valve being that it is entirely automatic in operation; requires no adjustment or setting for pressures; operates by steam pressure differential rather than by spring tension which may vary, and is designed to give complete atomization of the oil.



Cross-section of Madison-Kipp double diaphragm check valve

The check valve has the usual connections to the steam pipe or valve chamber, and to the lubricator, also a steam connection on top of the check valve for operating the diaphragm and furnishing steam to atomize the oil. The operation of the valve is as follows:

Referring to the illustration, the oil from the lubricator is forced into the check valve passage *A* from which it passes into the check valve chamber and operates against the diaphragm *B* in order to raise the check member *C* from its seat. When the oil pressure is not operative, the check valve is kept closed by steam at boiler pressure entering at *E* and operating against the diaphragm *F*. Under such conditions it is not possible for the steam pressure in the oil line to open the check valve against the steam pressure at *F*, due to the fact that the steam pressure at *F* has a greater effective area to operate against on the diaphragm than is the case at *B*, Therefore, when the boiler pressure is 200 lb., approximately 250 lb. of oil pressure is required to raise the check member *C*.

The oil atomizing feature consists in bi-passing some of the steam from *E* at all times through the passage *H* and mixing it with the oil at *J*. The ports are proportioned to give extremely fine atomization of the oil which occurs even when the engine is drifting.

P & B self-protecting oil burner

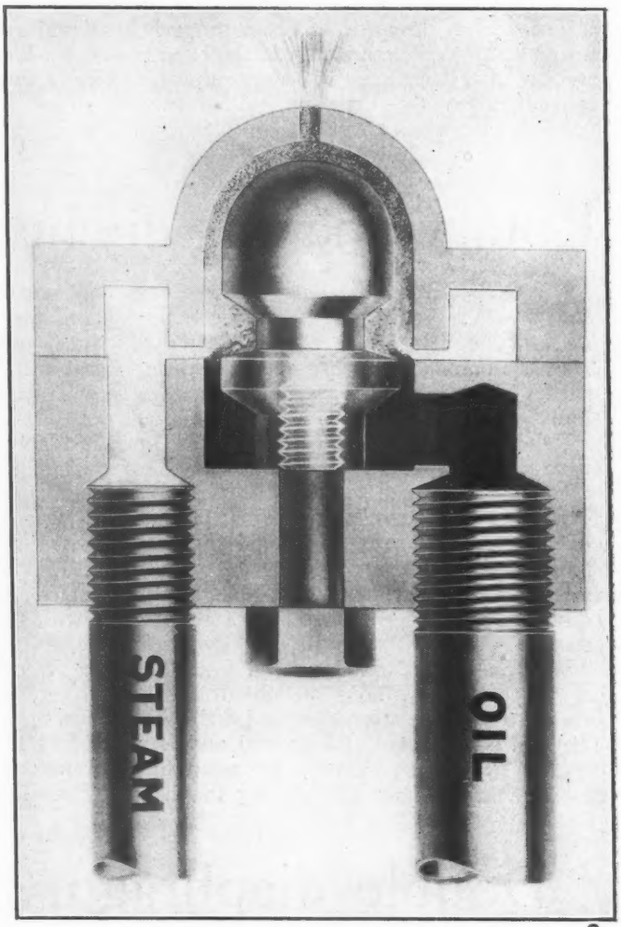
A SELF-PROTECTING oil burner which is said to use only 1.3 per cent steam has recently been placed on the market by F. Beers & Co., Federal Trust building, Newark, N. J. It has only three parts and is adaptable to any kind of flame to suit any type of furnace. It protects itself from overheating by absorbing the heat radiating through the cap into the steam used for atomizing.

The design of this burner is such that it causes the steam to break up the oil into very minute particles. The breaking up is done inside, not outside of the burner. Four inside steam jets are employed, all acting at right angles to four oil jets. Steam consumption is thereby reduced to a minimum.

The burner is of a compact design which gives it a number of advantages. It does not project far into the furnace, hence the danger of overheating, carbonizing, and clogging is minimized. Every inch saved in the length of the burner virtually adds an equal number of inches to the length of the furnace. There are no parts to adjust and get out of order. The correct size of oil and steam ports is determined by the pressures available and the capacity required.

In one test it is reported that a P & B burner, with 75 lb. oil pressure and 120 lb. steam, oil temperature 120 deg. F., 14 deg. Baume gravity, using four ¼-in. by 3/64 in. steam ports and four ¼-in. by 1/16-in. oil ports, with a ⅛ in. by 1 3/16 in. burner tip, actually developed 1,000 boiler hp. per hour, maximum. The same burner developed a minimum of 25 boiler hp. per hour, with a steady small fire. The burners can be altered for both larger and smaller capacity by changing the oil and steam ports and tip the openings.

The burner head is made of cast iron. Owing to accurate machining the two sections when bolted together by the four cap screws are steam and oil tight without the use of any gasket. The central plug is held in position by a single 5/16-in. cap screw and is also oil-tight without the use of a gasket. The plug is held in a central position so that equal amounts of mixture pass through all of the surrounding ports. At the same time equal amounts of steam pass through the ports from the steam section, impinging against the oil jets, and in the space surrounding the plugs, the oil becomes completely broken up, vaporized and mixed with the steam.



A cross-section of the P. & B. self-protecting oil burner

Model B 12-inch vertical shaper

THE Pratt & Whitney Company, Hartford, Conn., has placed on the market a 12-in. vertical shaper which has been developed to take the place of the old 10-in. model and to greatly extend its range. Operating convenience and the range of speeds and feeds are the outstanding features of this model. The three operating hand wheels are all located on the front of the machine. The feed reverse lever and the friction clutch lever are also within easy reach of the operator so that he has complete control of the machine without moving from the front of the machine. The convenience of the lever arrangement is shown in the illustration.

The basic principle of the vertical design remains unchanged in the 12-in. model. In accordance with modern practice the new model shaper is designed for either a built-in motor drive or a single pulley belt drive from a lineshaft. Either way the main drive pulley of the machine rotates at a constant speed of 440 r.p.m., so that power is used as efficiently as possible, regardless of the speed of cutting.

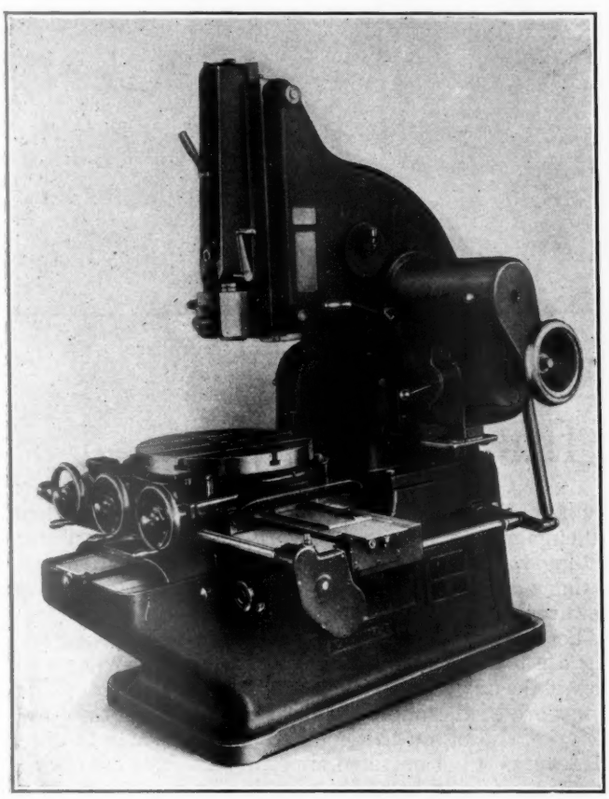
When arranged for individual motor drive a 5-hp. constant speed motor is mounted inside the bed. The floor space required for both the motor and belt-driven machines is, therefore, the same. The motor drives the large friction pulley at the side of the machine through a 3-in. belt. The belt tension is controlled by the screw adjustment of the hinged platform on which the motor is mounted. Space is provided on the column for whatever electrical control equipment is desired. The belt-driven machine requires no change other than the elimination of the few motor drive parts. In this case it is only necessary to belt the same driving pulley at the side of the machine to a lineshaft, using the same size of belt and the same pulley speed.

Power is controlled from the driving pulley by means of the friction clutch incorporated in it. This clutch is operated by a convenient lever on each size of the ram, which controls the motion of the machine at all times.

The lever has three positions: a working position, a neutral position and a third position which applies a brake for stopping the ram quickly. This friction clutch lever also actuates a segment and gear which provides a safety interlock to prevent any attempt to change the speed gears when they are in motion.

The power is taken into a gear box on the right side of the column. Four speeds and a neutral position are provided and an H-shift lever forms a convenient means of control. Power is taken from the gear box to the vertical ram by means of a large slotted eccentric and follower block which produces the slow power stroke and the quick return motion. An improved method of sight feed oil cup lubrication insures plenty of oil for the bearings at all times.

The ram slide and ram form a separate unit on the front of the column. The slide is heavily hinged at the top and has a heavy screw adjustment at the bottom so



Pratt & Whitney Model B, 12-in. vertical shaper designed for either motor or belt drive

that the entire unit may be swung to any angle desired up to 5 deg. and solidly locked in position. An angular scale is provided whereby the ram may be set and a new feature has been added which permits it to be returned to its true vertical position at once without additional adjustment.

The ram is thoroughly gibbed and is so designed that adjustments for wear are easily made. A handwheel attached to the gear box permits the ram to be easily moved through its entire travel for positioning at the start of a cut. The length of stroke of the ram is variable from zero to 12 in. by a lock nut adjustment on the end of the feed cam. The four speeds obtained from the gear box produce ram speeds of 22, 37, 56 and 90 strokes per minute.

The tool post is carried in a clapper so mounted that the thrust of the cut forces it rigidly against the head. This clapper permits the tool to clear the work on the return stroke. The tool post binder screw has been eliminated. The tool is held by drawing the tool post against it from the back This feature permits the tool post to pass over the work without interference as in no case does it project beyond the cutting edge of the tool. The tool head may be rotated a full 360 deg. and solidly clamped in any position.

Power feed for the machine is obtained from the feed cam on the upper right side of the column. This cam is driven by an extension of a shaft from the speed gear box so that it is always in correct relation with the speed of the ram. A side cam is used with a single rise which functions once for every stroke of the ram. The cam follower actuates a bell crank so that the feed is supplied by a rocker motion at the end of each stroke. The lever which connects the bell crank with the feed gear rod is adjustable on the crank for varying the amount of feed. This lever is made in the form of a safety device and consists of a sleeve containing a plunger and spring. The latter is stiff enough to transmit power for regular machine working conditions, but should the work or tool become jammed by careless handling, this plunger will simply pump up and down against the spring and no harm will result. An additional safety device is incorporated in removable cast iron guards which cover the feed cam and follower. A notched wheel and double pawl take the rocker motion delivered by the connecting rod to the notched wheel shaft and change it to an intermittent rotary motion. The feed gear box provides a forward, neutral and reverse feed drive by means of a bevel gear mechanism, and is controlled by a knob on the front of the bed convenient to the hand of the operator, the location of which is shown in the illustration.

A total transverse travel of 25 in. and a longitudinal travel of 25 in. are available. Handwheels and micrometer dials for hand traversing in either direction are provided and binders are furnished for locking both slides in position when desired.

The 24-in. rotary table provides ample surface for a wide range of work. It is provided with four indexing notches so that quick indexing may be had for surfaces to be machined at right angles to each other. Any other angle may be easily located by using the graduations provided on the table. A suitable handwheel, micrometer dial and binder are provided, and as all handwheels are entirely below the level of the table, there is no interference when placing large work on the table of the machine.

All handwheels are conveniently marked with arrows to show which motion is controlled by each wheel. The hand feed is disconnected and the power feed engaged by pushing in the knob on the handwheel, which operates a clutch. Each handwheel is provided with a micrometer dial which turns with both the hand and the power feeds. The range of feeds available is .0021 in. to .0833 in. for the transverse and longitudinal travels and .0043 in. to .1745 in. on a 10-in. radius for the rotary power feed, described in another paragraph.

The distance from the table top to the under side of the ram bearing is 14 in. and the maximum distance between the table and the ram itself is 24½ in. The tool post takes a tool ⅞ in. by 1⅝ in. The floor spaces occupied by the shaper with either belt or motor drive is 5 ft. by 7 ft. 2 in. and the overall height is 8 ft. 5 in. The machine with regular equipment weighs about 7,500 lb.

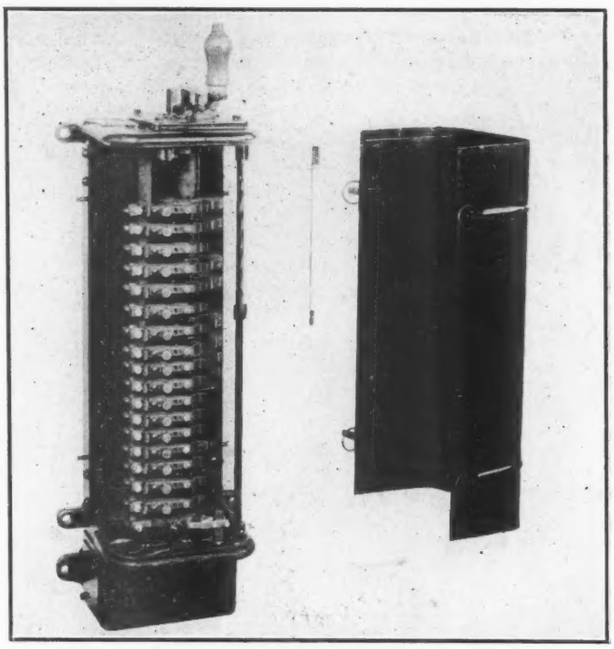
Drum controllers for machine tools

THE General Electric Company has recently placed on the market a new, completely standardized line of drum controllers, embodying new features of construction and comprising units for general purposes, crane hoist or machine tool applications, for either direct or alternating current. In each group several sizes have been provided to cover a wide range in motor ratings, the smaller sizes being suitable for wall mounting and those used for the larger motors being constructed for mounting on the floor.

A skeleton type of frame is used in the construction of these controllers. This consists of a cast cap plate and base, to which are hot riveted rectangular steel bars, thus making it unnecessary for the back of the switch to function as a framework for holding the top and bottom of the switch together. As a result, the switch is accessible from both back and front for the purpose of making adjustments, renewals, etc.

Operating handle mechanisms are interchangeable. A vertical operating lever or a spring return mechanism may easily be substituted for the horizontal lever with which the switch is equipped, by making use of another dial plate.

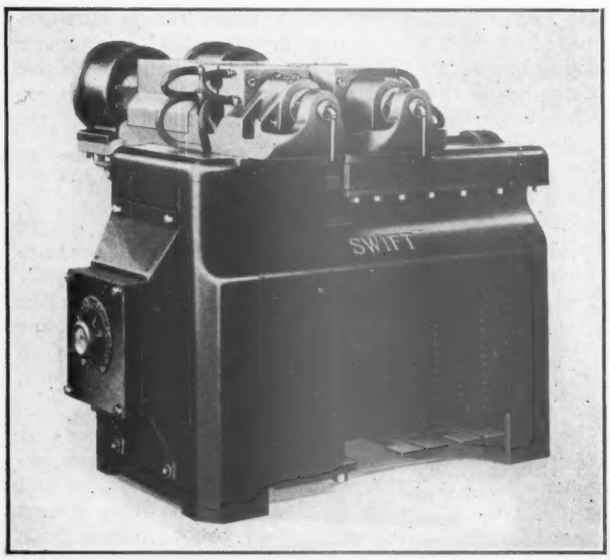
New style self-alineing contact fingers are used. By standardizing the renewable copper tips for all switches of the same capacity, renewal stocks will be reduced to a minimum. Where cross-arcing is likely to occur, adequate preventive barriers and blowouts are provided. Auxiliary contact fingers are provided for control circuits to the line protective switch. The arrangement of these circuits is designed to suit the service requirements of the installation.



Typical wall switch drum controller

Electric welder for flues and tubes

JOSEPH T. RYERSON & SONS, INC., Sixteenth and East Rockwell streets, Chicago, is marketing an electric flue welder recently developed by the Swift Electric Welder Company, Detroit, Mich. This machine was designed for safe-ending flues and also for the welding operations in reclaiming small pieces. With proper dies it can be used for any kind of butt welding. When not engaged on its regular work, it may be used for welding round or bar stock or for annealing, upsetting, heating and stretching, etc. The welder has a capacity for tubes in any size up to 6 in. in diameter.



The Swift electric welder which has a capacity for flues and tubes up to 6 in. in diameter

The welder is said to be flash proof, thus assuring long life to the winding and bearings. All moving surfaces slide on hardened and ground steel plates. The clamps are of the improved flash and slag proof adjustable type, sliding on hardened steel guide plates to minimize wear. Foot operated air cylinders leave the operator's hands free to handle the work. Three-fourths of a cubic foot of air at approximately 80 lb. pressure is required for a weld.

Two pairs of dies are used for each set. One set of dies handles work on both 2-in. and 3-in. tubes. On the large work a separate set of dies is required for each size of flues. All the dies are water cooled and have hardened steel guide plates to minimize wear.

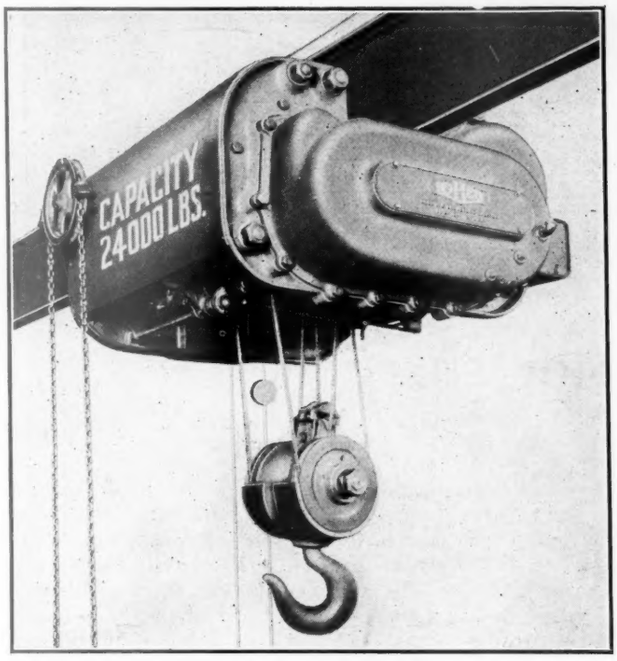
The machine is equipped with a pressure cylinder for pushing up the work. This cylinder may be connected either to a hydraulic accumulator, oil gear pump or a hand-operated oil-jack. A pressure of 800 lb. per sq. in. is required for 6-in. tubes, with proportionately less for smaller work. The volume required is .6 gal. per welding cycle.

The welder is operated by a remote control system, consisting of a contactor panel separately mounted and operated from a lighting circuit by a push button switch on the welder. By this method the power is entirely removed from the welder except at the instant of making the weld. This economizes on power and removes an ele-

ment of danger to the operator. The welder can be supplied for either 220- 440- or 550-volt primary circuit and preferably 60 cycles. The primary circuit is air-cooled; the secondary circuit, dies and die blocks are water cooled. The standard rating is 150 k. v. a. at an 85 per cent power factor.

New sizes of Lo-Hed electric hoists

SIX electric monorail hoists, ranging in capacities from 3 to 12 tons, have recently been placed on the market by the American Engineering Company, Philadelphia, Pa., as additions to its line of Lo-Hed hoists. Each of the new hoists is made in types for bolt suspension, hand-geared trolley, motor trolley and cab control. Open cabs are provided for indoor use and closed cabs for outdoor service. The hoists can also be supplied with push-button control or remote control.



The 12-ton Lo-Hed hoist

These hoists, which are designated as Class J, embody the same principles of design that characterize the other models of Lo-Hed hoists, with such additional features as are made necessary by the higher speeds at which they operate and the heavier loads they are designed to handle. Rated capacities are 3, 5, 6, 8, 10 and 12 tons, so that the complete Lo-Hed line now includes hoists from ½ ton to 12-ton capacity.

In all Lo-Hed hoists the drum and motor are placed on opposite sides of the I-beam track, so that the load block can be drawn up between them until it almost touches the rail. This utilizes all the available headroom and enables these hoists to handle the large loads and to stack goods at a maximum height.

The hoist operates on standard I-beams, through switches and around curves. Hyatt roller bearings on the trolley wheels and ball thrust bearings between the wheels and the trolley frames, combined with the straight spur gear drive and the fact that the wheels on both sides of the I-beam are driven, make the hoist move easily along the rail. The trolley trucks are swiveled for going around curves of short radius.

The ball-bearing hoisting motor is totally enclosed and drives the drum by spur gears running in oil. Hyatt bearings are provided on the ends of the shafts. The working parts are accessible for inspection and care by removing the cover of the hoist. The compact design eliminates all need for long shafts. The motor and pinion can be removed as a unit without taking off the gear cover or draining the oil from the gears. Safety features include a factor of safety of five in the design of the hoist; upper limit stop and a quick-acting brake that is automatically applied the instant the current is turned off, either accidentally or intentionally.

Sixteen-inch geared-head lathe

A SIXTEEN-IN., geared head Rapid Production lathe is now being built by the R. K. LeBlond Machine Tool Company, Cincinnati, Ohio, with automatic lubrication throughout. The headstock, feed and traverse mechanism and apron are all flood-lubricated and in addition, a submerged geared pump in the apron furnishes automatic forced lubrication to the carriage and cross-slide bearings. Hand-oiling is eliminated and no attention need be given to lubrication except to see that the proper oil level is maintained in the various units. Another feature of the machine is the use of Timken tapered roller bearings in the selective-speed geared headstock. The spindle, drive shaft and all intermediate shafts are mounted on bearings of this type.

A rapid power traverse for the carriage and cross-slide furnish maximum operating convenience and reduce the handling time and the time between cuts. The feed and the traverse to the carriage and the cross-slide in either direction are controlled through a single lever on the apron.

The drive is through a multiple-disk clutch in the driving pulley, and then through gear combinations to the spindle. The driving clutch embodies a quick-acting friction brake which is automatically engaged upon the release of the friction to bring the spindle to an instant stop. The friction is controlled by means of a handle on the front of the headstock. Six spindle speeds of from 47 to 450 r.p.m. are obtainable through two levers.

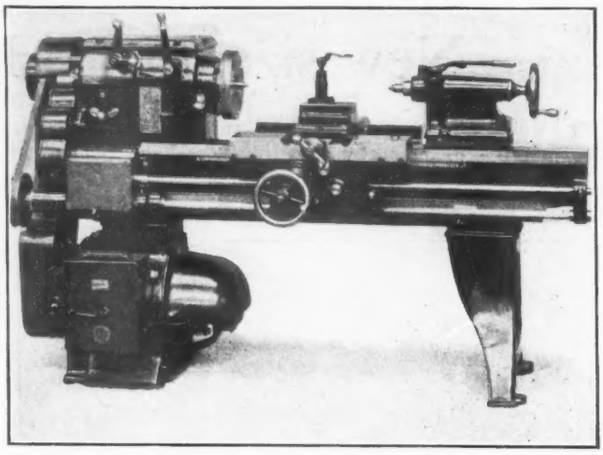
The drive for the geared feed mechanism is taken from one of the headstock intermediate shafts and delivered through a quadrant and system of change-gears to the feed shaft. Coarse feed changes are made through change-gears on the quadrant, and the intermediate fine changes by shifting a lever on the front of the headstock. Twenty-seven feeds, ranging from .003 in. to .108 in. per spindle revolution are available.

The rapid power traverse is incorporated in the feed mechanism and power is transmitted to the traverse shaft by belt from the driving pulley. The traverse is engaged by a lever on the apron, which shifts a double positive

jaw clutch, the traverse being effective both longitudinally for the carriage and transversely for the slide, in either direction. The same lever is also used to engage the longitudinal and cross feeds. The feed and traverse are interlocked so that they cannot be engaged at the same time.

The gearing in the apron is very simple; there are only six gears. All shafts have bearings at the front and rear. The apron handwheel is provided with a positive clutch which can be disengaged so that the handwheel will not revolve while the feed or power traverse is engaged. The bed is of the heavy-duty type with the compensating vee construction on the front shear. This construction provides a large carriage bearing area and insures lasting alinement. It furnishes a thrust bearing approximately at right angles to the tool pressure on any diameter of work within the swing of the machine. The tailstock is of the set-over type, and the top is graduated so that the amount of set-over may be accurately determined. It is clamped in position on the bed by two heavy bolts.

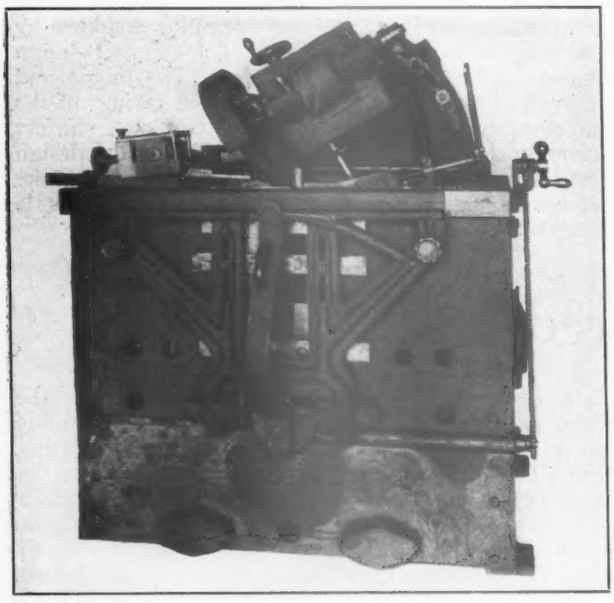
Either a geared or belted constant-speed motor drive, for alternating or direct current may be furnished. In the geared motor drive, the motor is mounted on top of the headstock, while in the belted motor drive, it is housed in the base of the front cabinet leg where it is completely enclosed and out of the way. A 5-hp. motor running at 1,200 r.p.m. is recommended.



LeBlond 16-in lathe which is automatically lubricated throughout

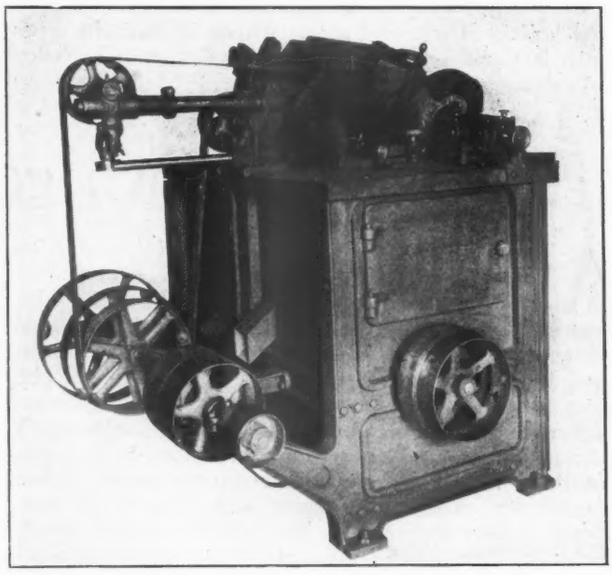
Automatic band saw sharpener

THE essential improvement incorporated in the automatic band saw sharpener recently developed by the Machinery Company of America, Big Rapids, Mich., is the timing of the feeding and grinding movements. In the older type machines, the action of the grinding head had to be timed to allow the feed finger to pass out of the throat of the tooth before the grinding wheel could engage the tooth point and throat. This not only required that the grinding wheel should remain suspended above the tooth a large percentage of the grinding interval, but caused a much more choppy, abrupt action of the wheel on the tooth during the actual grinding, and made the grinding contact much more severe on both the wheel and the saw, as well as on the machine mechanism.



Automatic band saw sharpener for saws 10 to 16 in. wide

The new action allows about 50 per cent more time for the wheel to engage the tooth, and thus enables a much smoother, less severe grinding action. The feed finger, after feeding each tooth to the grinding position, is immediately withdrawn inside the saw leaving the entire tooth free for the grinding wheel so that the wheel can engage the entire tooth from the point to the throat and up the back with a steady smooth movement of machine tool accuracy and precision which enables the perfect shaping and pointing of the teeth.



Rear view of the No. 188 automatic band saw sharpener

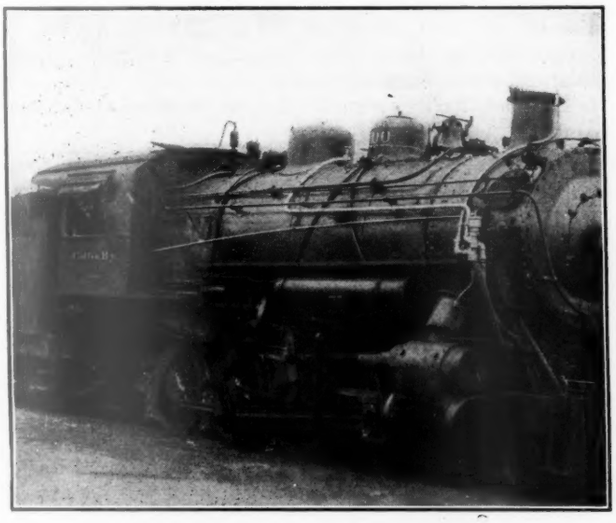
A straight line thrust of the feed finger is used for feeding the saw. A high-speed steel adjustable finger is

used to engage the face of the teeth at any point. The lift arm and feed arm pivoting and connections are designed for convenience of operation and maximum adjustment for a wide variety of service, with the length of the grinding head and feed finger movements readily adjustable to secure the grinding actions desired.

The head spindle carrying the arbor and grinding wheel runs in ball bearing. The grinding wheel mandrel is equipped with a ring oiler. An adjustment to afford any required bevel on the cut-off saws may be made without stopping the machine. All the parts are accessible for adjustment and repairs.

Automatic drifting throttle and relief valve

AN automatic drifting throttle and reilef valve has been designed and patented by W. W. Boulineau, master mechanic on the Central of Georgia at Cedartown, Ga., and is being sold by the Walraven Company, Atlanta, Ga. It has been thoroughly tested on Central of Georgia locomotives which tests results are



The valve is located on the right side of the boiler near the front end

said to have shown a saving in fuel consumption, increased mileage of cylinder packing rings, a reduction in carbon formation in the cylinders and valve chambers and a reduction in the cost of lubrication.

The drifting valve consists of two large chambers, one at each end of the valve, joined together by a long chamber of smaller diameter. The top chamber, which contains the floating operation piston, has an outlet to which is connected a ⅜-in. pipe leading to a three-way valve in the cab. The bottom chamber, which contains the large differential attached piston, has an outlet for a ⅜-in. pipe which leads to the steam pipe. The middle chamber contains three openings. The one admits steam from the steam dome, the other steam from the cylinders and the third is the connection to the atmosphere or exhaust. This cylinder contains three pistons mounted on a common piston rod, at the lower end of which is attached the differential piston, at the upper end the smaller differential piston and in the middle two piston valves.

When the two piston valves are over the opening leading to the cylinders, the differential pistons are balanced by steam entering from the steam dome underneath the small piston and by steam entering from the steam pipe underneath the large piston. The device is then in the running position.

When the main throttle is closed a partial vacuum is formed in the lower chamber by means of the ½-in. pipe connection from the locomotive valve chamber. Atmospheric pressure then acts against the opposite side of the large differential piston, thus moving it from its running position. In this position steam is admitted to the cylinders from the dome. The valve is now in the drifting position.

The valves are moved to the relief position by the steam in the operating valve chamber being exhausted to the atmosphere through the ⅜-in. pipe leading out of the top of the chamber and the three-way valve in the cab operated by the engineman together with the steam from the valve chambers acting against the large differential piston. The steam from the cylinders will then pass to the atmosphere through the pipe leading from the cylinder out through the pipe leading to the exhaust. The valve will remain in this position until steam is again admitted to the chamber containing the floating piston by the operation of the three-way valve.

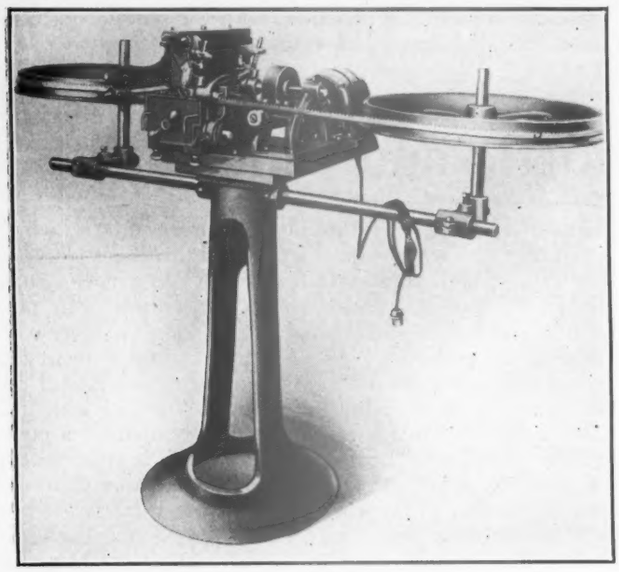
Band saw filer and setter

THE Wardwell Manufacturing Company, 110-112 Hamilton avenue, Cleveland, Ohio, has recently developed a combination band saw filer and setter designed to file, set and joint band saw blades in one operation. The machine is constructed in types for use as a bench machine or it may be mounted on a pedestal. One model, K, is used for woodworking band saw blades. It will handle saws from ⅛ in. to 2 in. in width, with from 2 to 15 teeth to the inch. Model K-2 is for medium or spring tempered metal cutting band saws from ⅛ in. to 2 in. wide, up to 26 teeth to the inch. Either model may be arranged, for use with direct-motor or belt drive as desired.

The machine shown in the illustration is a pedestal-mounted direct motor driven model equipped with adjustable wheels for carrying the saw being resharpened. A door, held by one large wing nut, may be removed, which opens the entire front of the machine for inserting the saw blade. This door forms the front jaw of a vise for holding the saw, the rear jaw of which is acted upon by double cams which are adjustable.

Power is transmitted through a flexible coupling to a worm and gear. The motor worm shaft is fitted with a ball thrust bearing. The filing arm, which runs in bronze-lined guides, receives its motion from a hardened steel cam working on a chilled casting. The roller and cam screw are hardened and ground. The file is rigidly set in the filing arms and the adjustment controls the

depth of cut. This is said to cause the teeth in hard spots in the saw blade to be cut to the same depth as in the soft spots with a consequent cleaning out of the gullet

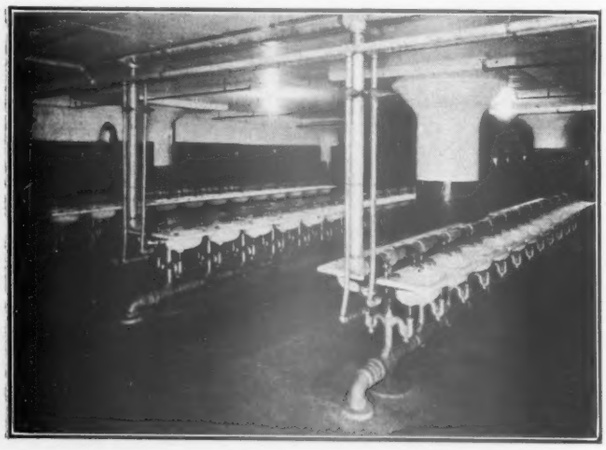


Pedestal-mounted Wardwell saw filer with adjustable wheels for carrying the saw blade

under all conditions of the steel. It is said to be possible to file and set saws with this machine at the rate of 70 teeth a minute.

Individual sanitary washbowls

THE accompanying illustration shows three batteries of individual sanitary washbowls, each with a common water waste. The bowls are of heavily vitrified porcelain enamel and hold two gallons of water. The most modern type of plumbing construction, such as waste connection with recess joints, etc., has been followed. The upright from the top of the structure to and



Three double rows of wash bowls, each battery connected to a common water supply and waste pipe

below the waste pipe is one casting, including the traps, thus reducing the number of joints to a minimum. The structure, erected, forms a complete unit. All that is necessary is to connect the water supply, vent and waste.

There is room enough at each bowl for every man without crowding. The width of two rows of washbowls placed back to back is 34 in. x 5/8 in. This equipment is manufactured by the Manufacturing Equipment & Engineering Company, Boston, Mass.

Metal melting pot with a large capacity

A METAL melting pot, with a capacity of approximately 1,000 lb. has recently been placed on the market by the General Electric Company, Schenectady, N. Y. This pot, utilizing the electric heating principle, is practically the same as other standard General Electric melting pots except that three cast-in, sheath wire immersion heating units are used instead of two heating units of similar design.

Each heating unit is rated at five kilowatts. The pot may be operated either on 110 or 220-volt. a.c. or d.c. circuits and the use of three heating units will also permit balanced three-phase operation.

The pot itself consists of a sheet steel, cylindrical

An electric metal melting pot with an approximate capacity of 1,000 lb.

casing in which is supported a cast-iron crucible, 18-in. in diameter by 15 in. in depth inside, and 29 in. in diameter by 31 in. in depth outside. The space between the casing and the crucible, measuring about three inches, contains a compact heat insulator. The leads of the heating units are brought over the top of the pot into a connection box fixed to the unit itself.

Melting pots of this type are designed for melting lead, babbitt, tin, solder and similar alloys or metals, except spelter or zinc, at temperatures not exceeding 850 deg. F.

Full-automatic control is recommended, consisting of a standard automatic control panel and a temperature control instrument equipped with a special bulb for metal immersion. Separate heating units may be installed in existing installations of melting pots where dimensions permit and where the required temperatures do not exceed 850 deg. F.

News of the Month

Rail motor cars for passenger traffic on the Victorian Railways are being used more and more extensively. The railway commissioners are considering the adoption of oil-electric drive coaches to take the place of the single-ended gasoline coaches of comparatively low power which have been in use for some time.

The first complete locomotive to be constructed in Rumania was delivered in September to the Rumanian State Railways. It was built entirely at the Reshitza Metallurgical Works. The locomotive is a standard-gage, oil-burning type, weighing 88,000 kilograms. The Reshitza works are now equipped to turn out 80 locomotives of this type per annum, which means, it is claimed, that Rumania will no longer need to import locomotives.

Representatives of the shop crafts of the International-Great Northern and representatives of the road organized a system board of adjustment for the differences which arise among employees and employers, at Palestine, Tex., on October 13. The employees and the management have equal representation on this board and the board will decide disputes growing out of personal grievances or applications of shop-crafts schedules and practices in cases which cannot be adjusted through customary channels.

The Pennsylvania, on Wednesday of this week, announced that the shopmen of the company, numbering more than 43,000 mechanics, helpers and apprentices had been granted an advance in pay of three cents an hour effective October 16, bringing the general rate up to 76 cents, the same as that granted by the New York Central September 1. This advance follows several weeks' conference at Pittsburgh. The committees representing the employees were elected by the employees themselves from among their own number.

Court news

AUTOMATIC COUPLERS UNDER SAFETY APPLIANCE ACT.—The Circuit Court of Appeals, Sixth Circuit, holds that an employee may recover for an injury sustained through failure to equip a car with automatic couplers as required by the Safety Appliance Act although neither he nor the car was at the time engaged in interstate commerce.—Detroit United Ry. v. Craven, 13 F. (2d) 352.

Wage statistics for July

The number of employees reported by Class I steam roads to the Interstate Commerce Commission as of the middle of the month of July, 1926, was 1,857,219, an increase of 23,598, or 1.3 per cent, over the number for June, 1926. The total compensation shows an increase of $5,562,159, or 2.2 per cent. The greater percentage increase in compensation is due to an increase in the number of hours worked per employee, and a larger proportion of overtime.

Compared with the returns for the corresponding month last year, the number of employees reported in July, 1926, increased 3.4 per cent, and the total compensation increased 3.6 per cent.

Equipment installed

Class I railroads during the first eight months this year installed in service 1,440 locomotives, the Car Service Division of the American Railway Association has announced. This was an increase of 227 over the number installed during the corresponding period last year but 57 below 1924. Locomotives on order on September 1 totaled 533, compared with 193 on the same date last year and 324 in 1924.

Freight cars installed in service during the first eight months totaled 77,225, a decrease of 28,221 under the corresponding period in 1925, and 27,731 under 1924. Of these 10,967 were placed in service during August, including 4,619 box cars, 5,145 coal cars and 679 refrigerator cars.

Class I railroads on September 1 had 20,251 freight cars on order compared with 20,863 on the same date last year and 41,476 in 1924. These figures as to freight cars and locomotives include new and leased equipment.

Car inspector submits winning safety slogan

In a safety slogan contest conducted by the Pennsylvania at its east car shops at Ft. Wayne, Ind., more than 500 slogans were submitted by the employees. The winning slogan was one submitted by a car inspector—

THE WORK IS DANGEROUS, THE HOSPITAL IS WORSE;
LET'S GET TOGETHER AND BOOST SAFETY FIRST.

Other slogans winning places in the contest were, "One way, the right way, the safety way," submitted by a machine operator; "A safe day's work means a full day's pay, and a chance to prepare for a rainy day," by a car repair helper; and "Safety today for service tomorrow," by a car repair helper.

The winning slogans will be painted within large keystones on the walls of the shop buildings as constant reminders to the employees to eliminate accidents. A committee of 12 shopmen acted as judges.

Meetings and Conventions

The Louisiana Car Department Association was recently organized in New Orleans, La., by car foreman, car inspectors, etc., the chartered members totalling 140. The association holds meetings on the third Thursday of each month. Besides car foremen, car inspectors, etc., railway supply men are eligible for membership. Officers of the club are Ugo Mendall, president; T. L. Butvher, first vice-president; E. A. Banks, second vice-president; J. E. Durand, treasurer; L. Brownlee, secretary, and J. D. Ernst, chairman of the publicity committee.

International Conference on Bituminous Coal to Be Held at Pittsburgh

The program for the International Conference on Bituminous Coal to be held at the Carnegie Institute of Technology, Pittsburgh, Pa., November 15 to 18, includes quite a number of outstanding engineers in both Europe and America. Among those who have accepted invitations to speak at this conference are Dr. Friedrich Bergius of Heidelberg, Germany, inventor of the Bergin method of producing petroleum from coal; Jean Bing, director of technical service, Coal Tar Products and Distillers Association, Paris, France; Dr. C. H. Lander, director of fuel research of the Department of Scientific and Industrial Research, England; and Geoffrey M. Gill, fuel technologist and gas specialist, London, England. In addition, A. C. Fieldner, chief chemist of the U. S. Bureau of Mines and superintendent of the Pittsburgh Experimental Station; Professor S. W. Parr, University of Illinois; and Osborn Monnett, smokeless fuel specialist of Chicago, will speak. Sectional meetings will be devoted to the subjects of smokeless fuel, power, high temperature distillation, fertilizers, gasification and coal tar utilization.

Subjects that should be of interest to railroad men is a paper by Marius Campbell, U. S. Geological Survey, Washington, D. C. on "Our coal supply, its quantity, quality and distribution," which is scheduled for Monday, November 15; a paper by Jean Bing on "The technical and commercial phases of coal utilization," which is scheduled for Tuesday; and the session of the smokeless fuel section to be held at 9:30 a. m., Wednesday. Three papers, one on "The economic aspects of the pre-treatment of coal for smokeless fuel," by Dr. Horace C. Porter, consulting chemical engineer, Philadelphia; "Smokeless fuel," by O. P. Hood, chief mechanical engineer, U. S. Bureau of Mines, Washington, D. C.; "Smoke problem of cities," by Osborn Monnett, will be presented at the session of the smokeless fuel section.

Exposition of Power and Mechanical Engineering to be held December 6 to 11

The fifth national exposition of Power and Mechanical Engineering, including heating and ventilating, will be held December 6 to 11, 1926, at the Grand Central Palace, Lexington avenue and Forty Sixth street, New York. This is during the same week as the annual meeting of the American Society of Mechanical Engineers, which meets December 6 to 9, inclusive and the American Society of Refrigerating Engineers, which will hold its sessions at the Hotel Astor for three days starting Tuesday, December 7. The educational value of the exposition is being developed as far as possible, as this annual event brings together not only the leaders in engineering and industry, but a considerable number of the general public who desire up-to-date information about developments in applied science. The exhibits themselves will consist largely of working units or models. In addition, a complete program of motion pictures has been provided showing a number of the larger and more recent developments in engineering. One of the exhibits will be under the auspices of the Museum of the Peaceful Arts, which is engaged in the development of plans for an industrial museum in New York City.

Fall meeting American Welding Society

Technical sessions, exhibitions and demonstrations will be held in connection with the annual fall meeting of the American Welding Society at the Broadway Auditorium, Buffalo, N. Y., November 16, 17, 18 and 19. A large variety of welded products will be a unique feature of the exposition of welding apparatus and supplies which will open on Tuesday afternoon, November 16. The technical sessions will begin Wednesday morning at 10 a. m. During these sessions the progress made by the welding research department of the American Welding Society (American Bureau of Welding) will be discussed. The program for the meeting is as follows:

WEDNESDAY, NOVEMBER 17—MORNING

Welding of Locomotive Parts, by M. Gjersten, master welder, Northern Pacific Company.
Organization of Welding on the Railroad, by F. H. Williams, assistant test engineer, Canadian National.

AFTERNOON

Comparative Tests on Arc and Riveted Structural Members, by A. M. Candy, general engineering department, Westinghouse Electric & Manufacturing Company.
Tests on Welded Roof Truss, by H. H. Moss, Linde Air Products Company.

THURSDAY, NOVEMBER 18—MORNING

Welding Science in the Engineering Curriculum of Universities, by Prof. G. J. Hoffman, Purdue University; Prof. B. L. Lucas, Mississippi Agriculture and Mechanical College; Prof. S. T. Hart, Syracuse University; Professor deZafra, New York University; Prof. R. D. Rickley, Ohio State University; Prof. F. V. Larkin, Lehigh University.

AFTERNOON

Welding Wire Specifications Committee, C. A. McCune, chairman.
Meeting of the American Bureau of Welding.
Dinner dance.

FRIDAY, NOVEMBER 19—MORNING

Short technical session on Welding in a Gaseous Atmosphere, including demonstrations, and exhibitions will be made by P. P. Alexander and R. A. Weinman, of the General Electric Company.
Meeting of Board of Directors.

AFTERNOON

Inspection trip to Niagara Falls Power House.

Mechanical division, A. R. A., adds new subjects for committee work

Two new committees, one on Automotive Rolling Stock, and one on Lubrication of Cars and Locomotives, have been added to the list of standing committees which will serve the Mechanical Division of the American Railway Association until June, 1927, according to Circular No. DV-486 which gives the complete personnel of all committees for the coming year. The list of standing committees, together with their chairmen, is as follows:

A—Arbitration—T. W. Demarest, general superintendent motive power, Northwest Region, Pennsylvania System, Chicago.
A-1—Prices for Labor and Materials—A. E. Calkins, superintendent rolling stock, New York Central, New York.
B—Autogenous and Electric Welding—J. T. Wallis, chief motive power, Pennsylvania System, Philadelphia, Pa.
C—Car Construction—W. F. Kiesel, Jr., mechanical engineer, Pennsylvania System, Altoona, Pa.
C-1—Brakes and Brake Equipment—G. H. Wood, general air brake instructor, Atchison, Topeka & Santa Fe, Topeka, Kan.
C-2—Couplers and Draft Gears—R. L. Kleine, assistant chief motive power, Pennsylvania System, Philadelphia, Pa.
D—Design of Shops and Engine Terminals—W. A. Callison, superintendent motive power, Chicago, Indianapolis & Louisville, LaFayette, Ind.
E—Electric Rolling Stock—L. K. Sillcox, general superintendent motive power, Chicago, Milwaukee & St. Paul, Chicago, Ill.
F—Loading Rules—R. L. Kleine, assistant chief motive power, Pennsylvania System, Philadelphia, Pa.
G—Locomotive and Car Lighting—W. E. Dunham, superintendent car department, Chicago & North Western, Chicago.
H—Locomotive Design and Construction—H. T. Bentley, general superintendent motive power and machinery, Chicago & North Western, Chicago.
I—Safety Appliances—C. E. Chambers, superintendent motive power and equipment, Central of New Jersey, Jersey City, N. J.
J—Specifications and Tests for Materials—F. M. Waring, engineer of tests, Pennsylvania System, Altoona, Pa.
K—Tank Cars—A. G. Trumbull, chief mechanical engineer, Erie, New York.
L—Wheels—C. T. Ripley, chief mechanical engineer, Atchison, Topeka & Santa Fe, Chicago.
M—Automotive Rolling Stock—C. E. Brooks, chief motive power, Canadian National, Montreal, Canada.
N—Lubrication of Cars and Locomotives—W. O. Forman, mechanical superintendent, Boston & Maine, Boston, Mass.

A. S. M. E. annual meeting

The annual meeting of the American Society of Mechanical Engineers will be held at the Engineering Societies' building, 29 West Thirty-ninth street, New York, December 6 to 9, inclusive. The regular council meeting and conference of local sections delegates will be held on Monday, December 6. The various sectional meetings will be held on the succeeding days, the following tentative program having been arranged:

TUESDAY, DECEMBER 7.

9:30 a.m.—Industrial Power Division.
Textile Division.
Wood Industries Division.
Power Test Code Public Hearing.
2:00 p.m.—Fuels—Smoke Abatement.
Railroad Division.
Joint session with A. S. R. E. Program arranged by sub-committee on Heat Transmission of N. R. C.
General (I).
4:30 p.m.—Robert Henry Thurston Lecture.
Evening—Presidential address and reception; John Fritz medal award to Dr. Elmer A. Sperry.

WEDNESDAY, DECEMBER 8

9:30 a.m.—Fuels—By-product Processing of Coal.
Machine Shop Practice Division (1) jointly with Research Sub-committee on Cutting and Forming of Metals.
Material Handling Division.
General (II).
2:00 p.m.—Business meeting and general session.
3:00 p.m.—Education and Training for the Industries.
Student Branch Conference.
Steam Tables Research.
3:30 p.m.—Ladies' tea.
Evening—Annual dinner.

THURSDAY, DECEMBER 9

9:30 a.m.—Central Station Power Division.
Management Division (I).
Machine Shop Practice Division (II)
Aeronautic Division.
2:00 p.m.—Management Division (II), jointly with Taylor Society.
Oil and Gas Power Division.
Springs—Open session of Special Research Committee on Mechanical Springs.
Petroleum Division.
Power—Jointly with Research Sub-committee on Boiler Feedwater Studies.
4:30 p.m.—Henry Robinson Towne Lecture.
Evening—College Reunions.

At the railroad session at 2 p. m. Tuesday, papers will be read on The Use of High Pressure Steam in Locomotives, by E. C. Schmidt, professor railway engineering department, University of Illinois, Urbana, Ill., and J. M. Snodgrass, professor railway mechanical engineering, University of Illinois, and on Balancing Factors in Use and Obligations Covering Ownership of Freight Train Cars, by L. K. Sillcox, general superintendent motive power, Chicago, Milwaukee & St. Paul, Chicago. Also at the second management session at two o'clock Thursday afternoon, a paper on Railroad Organization will be presented by J. C. Clark, of the staff of Industrial Relations Counsellors, Inc.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—Next meeting May 24, 25, 26 and 27, Mayflower Hotel, Washington, D. C.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago.
DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.
DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church St., New York. Annual meeting December 6 to 9.

AMERICAN SOCIETY FOR STEEL TREATMENT.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth St., New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

BIRMINGHAM CAR FOREMEN AND CAR INSPECTORS' ASSOCIATION.—P. H. Gillean, 715 South Eightieth Place, Birmingham, Ala. Meeting, second Monday in each month at Birmingham Y. M. C. A. Building.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting November 9. Paper on transportation will be read by C. R. Moore, general superintendent transportation, Canadian National, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill. Next meeting November 8. Paper on wheels will be read by C. T. Ripley of the Atchison, Topeka & Santa Fe.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. D. Wiegmar, 720 North 23rd St., E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club Building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St. New York, N. Y. Regular meetings, second Thursday each month, except June, July and August, Hotel Statler, Buffalo, N. Y. Next meeting November 11. Lecture will be given on the story of compressed air, with five reel film. Will be preceded by talk on Oxygen, the Wonder Worker, by C. E. Harcke, with interesting experiments with liquid oxygen.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt railway, Clearing Station, Chicago.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 811 Union Central Building, Cincinnati, Ohio. Meetings, second Tuesday, February, May, September and November. Next meeting November 9, Hotel Gibson, Cincinnati.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Frericks 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month except July, August and September, at Hotel Hollenden, East Sixth and Superior Ave., Cleveland, Ohio.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILMAY FUEL ASSOCIATION.—L. G. Plant Railway Exchange, 80 E. Jackson boulevard, Chicago. Annual convention May 10 to 13, 1926, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Rve., Winona, Minn.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, New Orleans, La. Meeting third Thursday in each month.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September, Copley-Plaza Hotel, Boston, Mass. Next meeting November 9. Canadian night. W. M. Neal, assistant to vice-president, Canadian Pacific, will speak.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York. Next meeting November 19. Electrical night.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately. Next meeting November 11, Palace Hotel, San Francisco. Annual Associate Members night. All associate members will be given an opportunity to speak briefly upon any subject he may choose.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August. Next meeting November 12, Statler Hotel. Paper on rapid transit will be presented by C. E. Smith, consulting engineer, City of St. Louis.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting November 18, Ansley Hotel, Atlanta.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—C. Kimball, Inman shops, Southern, Atlanta, Ga.

TEXAS CAR FOREMEN'S ASSOCIATION.—A. I. Parish, 106 West Front St., Fort Worth, Tex. Regular meetings, first Tuesday in each month, Terminal Hotel Bldg., Fort Worth, Tex.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

The Pyle National Company, Chicago, will construct a one-story plant, 22 ft. by 61 ft.

J. P. Carney, sales service engineer of the Grip Nut Company, Chicago, died on October 16 at Fond du Lac, Wis.

The Air Reduction Company, Inc., New York, has acquired all the assets of the Dayton Oxygen & Hydrogen Products Company, Dayton, Ohio.

J. R. Brandt has joined the Cleveland, Ohio, office of the Bridgeport Brass Company as raw material salesman in the Pittsburgh territory and parts of Ohio.

The Geometric Tool Company, New Haven, Conn., has appointed R. S. Stokvis & Fils, 20 Rue des Petits Hotels, Paris, France, as its exclusive agent for France.

Charles F. deBrunner has been appointed manager of the newly created plate and structural division of the North American Car Corporation, with headquarters at Tulsa, Okla.

Evan J. Parker, formerly of the Morgan Engineering Works, Alliance, Ohio, has been placed in charge of the sales promotion division of the Northern Engineering Works, Detroit, Mich.

The Davis Brake Beam Company, Pittsburgh, Pa., has discontinued its Roanoke, Va., office and future business in that territory will be taken care of by the general sales office at Pittsburgh.

The name of the Wayne Tank & Pump Company, Fort Wayne, Ind., has been changed to the Wayne Company. The change is in name only and in no way affects the business status or policies of the company.

R. C. Brower of the Automotive and Industrial Machinery Sales division of the Timken Roller Bearing Service and Sales Company, has been promoted to general manager, with headquarters at Canton, Ohio.

George Boehner has joined the sales organization of the American Hammered Piston Ring Company, with headquarters at Minneapolis, Minn. Mr. Boehner's territory will include Minnesota and North and South Dakota.

F. R. Pfaff, assistant advertising manager of Albert Pick & Company, has been appointed advertising manager of the Independent Pneumatic Tool Company, Chicago, to succeed Frank F. Leavenworth, resigned, to engage in other business.

The Parkesburg Iron Company, Parkesburg, Pa., will temporarily suspend the manufacture of charcoal iron boiler tubes in order to pursue plans for the diversification of its products. Changes in facilities also are to be made.

George E. Tyson, who for the past twelve years has been in the production department of the Reading Iron Company, Reading, Pa., has been appointed representative in the Reading territory. Mr. Tyson's headquarters are in the general offices of the company at Reading.

George E. Watts, 1523 Chandler building, Atlanta, Ga., has been appointed special representative of the J. S. Coffin, Jr., Company, Jersey City, N. J. For 18 years prior to his association with this company he was the southern representative of the Duff Manufacturing Company.

Charles C. Phelps, 473 Getty avenue, Paterson, N. J., has been appointed to handle the Marley superheater in New York City and Northern New Jersey. This superheater is made by the Power Plant Equipment Company, Kansas City, Mo., and is especially designed for use with horizontal return tubular boilers and other boilers of the fire tube type.

The North American Car Corporation, Chicago, has acquired control of the Palace Poultry Car Company, Chicago. Officers of the new company are: President, Erwin R. Brigham, vice-president of the North American Car Corporation; vice-president and general manager, I. V. Edgerton, vice-president and general

manager of the Palace Poultry Car Company; and secretary-treasurer, N. M. Stott, assistant secretary of the North American Car Corporation.

J. C. Morrell, formerly in the automotive division of the Westinghouse Air Brake Company and later assistant to district engineer of the same company and the Westinghouse Traction Brake Company, has been appointed representative of both companies, with office at New York.

Leland Brooks, formerly vice-president and treasurer of the Franklin Railway Supply Company, Ltd., Montreal, has been appointed special representative of the Worthington Pump & Machinery Corporation, with headquarters at Chicago. In addition to other duties Mr. Brooks will handle railroad sales in Canada.

E. C. Sicardi, president of the Union Tank Car Company, at New York, retired recently, after a service of about 36 years. E. L. Gridley, treasurer, has been elected a vice-president and secretary, with headquarters at Chicago. The executive and general offices of this company have been moved from New York City to 134 North La Salle street, Chicago.

R. E. Prussing, for many years district sales manager of the Whiting Corporation at Detroit, Mich., has taken up duties at the main office, Harvey, Ill. W. R. Hans, district manager at Buffalo, N. Y., succeeds Mr. Prussing at Detroit. Sales in the Buffalo territory will hereafter be handled by C. G. Crewson, Arthur E. Smith, and associates, Industrial Equipment Company, 306 Jackson building, Buffalo.

James H. McNulty, president of Pratt & Lambert, Inc., Buffalo, N. Y., died on October 17 from injuries received in an automobile accident on the day previous, near Buffalo. Mr. McNulty was a banker, took an active interest in civic affairs and was well known in the paint and varnish industry, having served as president of the National Varnish Manufacturers' Association in 1914. He first entered the service of Pratt & Lambert, Inc., in 1892 and was steadily promoted until he became president of the company in 1917.

W. H. Winterrowd, assistant to the president of the Lima Locomotive Works, Inc., has been elected a vice-president, with headquarters at New York. Mr. Winterrowd was born on April 2, 1884, at Hope, Ind. He attended the public schools at Shelbyville, Ind., and is a graduate of Purdue University, Class of 1907. During his college vacations, Mr. Winterrowd was employed as a blacksmith's helper on the Lake Erie & Western at Lima, Ohio, and as a car and air brake repairman on the Pennsylvania Lines West, at Dennison, Ohio. After graduation he obtained employment as a special apprentice on the Lake Shore & Michigan Southern, and in 1908 entered the service of the Lake Erie, Alliance & Wheeling as enginehouse foreman at Alliance, Ohio. In 1909 he became night enginehouse foreman of the Lake Shore & Michigan Southern at Youngstown, Ohio, and in 1910 was promoted to roundhouse foreman at Cleveland. A second promotion later in the same year made him assistant to the mechanical engineer. From September, 1912, to 1915, he was mechanical engineer of the Canadian Pacific, during the latter year being appointed assistant chief mechanical engineer, and in 1918, chief mechanical engineer, in which position he remained until 1923 when he was appointed assistant to the president of the Lima Locomotive Works. Mr. Winterrowd was at one time a member of the General Committee of the American Railway Association and is a member of the American Society of Mechanical Engineers.

W. H. Winterrowd

Gerald Firth, for the past eight years works manager of the Firth-Sterling Steel Company, McKeesport, Pa., has been appointed general manager. He was born on December 16, 1886, at Sheffield, England, and was educated at Uppingham School and at Trinity College, Cambridge. His ancestors have been connected with the steel business since 1842 in England and 1855 in the United States. The Firth-Sterling Steel Company was organized in 1896 at McKeesport, Pa., to manufacture fine steel products including high grade tool steel. In February, 1910, Gerald Firth went to the Firth-Sterling Steel Company and was engaged in investigating the requirements of the business in the United States; later he took up the study of tool and die steel at the Sheffield works of Thos. Firth & Sons, Ltd. In addition to his experience in the crucible and other departments at Sheffield he worked at the bench for nearly two years and obtained a thorough and practical knowledge of different types of defects, fractures and workmanship of finished high speed and tool steel bars. In 1914 he returned to the Firth-Sterling Steel Company and made both stainless steel and stainless iron. During the World War, Mr. Firth served overseas as lieutenant in the field artillery of the English army. In May, 1918, he returned to the works of the Firth-Sterling Steel Company at McKeesport, Pa., as works manager.

L. Gerald Firth

Frederick M. Nellis, special representative at New York of the Westinghouse Air Brake Company and secretary since 1899 of the Air Brake Association, died suddenly in his office on October 16. Mr. Nellis was born on February, 27, 1862, at Tionesta, Pa. At the age of 16 he learned the machinist trade at Dennison, Ohio, and after serving an apprenticeship as locomotive fireman, became a locomotive engineman on the Panhandle division of the Pennsylvania Railroad. He was throughout the remainder of his life a member of the Brotherhood of Locomotive Engineers. He entered the service of the Westinghouse Air Brake Company in 1882 as a demonstrator on its instruction car. At the age of 34, Mr. Nellis entered Cornell University, taking a special course in mechanical engineering. He graduated with the class of 1899, and then resumed his association with the Westinghouse Air Brake Company, serving in various responsible positions. About 1911 he was representative of the New England district at Boston, Mass., and since 1915 had been a special representative of the company at New York. Mr. Nellis was one of the early members and leaders of the Air Brake Association and his services contributed largely to the association's success. He became secretary of the association in 1899 and in 1924, as a compliment to his work, the association made him secretary for life. Mr. Nellis was for a number of years on the editorial staff of Locomotive Engineering and contributed many articles on air brake practice and locomotive and train operation.

F. M. Nellis

Personal Mention

General

O. A. GARBER, assistant chief mechanical officer of the Missouri Pacific, with headquarters at St. Louis, Mo., has been appointed chief mechanical officer, with the same headquarters, succeeding W. H. Fetner, deceased.

T. W. LOVE, general road foreman of engines of the Missouri Pacific, has been appointed trainmaster of the Wagoner district of the Central division, with headquarters at Van Buren, Ark., succeeding S. E. Willis, deceased.

M. W. HASSETT, whose appointment as assistant superintendent of motive power of the New York Central, with headquarters at New York, was announced in the October *Railway Mechanical Engineer*, was born on May 29, 1875, at Crittenden, N. Y. He received his education at Niagara University, and first entered railroad service on July 1, 1896, as a telegrapher with the New York Central. He entered the motive power department of the same company in December, 1899, and was promoted to master mechanic, with headquarters in Buffalo, N. Y., on December 15, 1909. In September, 1920, he was appointed general master mechanic of district number 2, with headquarters at Buffalo, N. Y.

RAY M. BROWN, whose appointment as superintendent of motive power of the New York Central was announced in the October *Railway Mechanical Engineer*, was born in Ashtabula, and on April 9, 1879. He was educated in the public schools, and first entered railroad service on October 9, 1899, as a machinist apprentice with the Lake Shore & Michigan Southern, with headquarters at Cleveland, O. He subsequenty held the position of machinist and draftsman until April, 1910, when he was promoted to the position of chief draftsman, with headquarters at Elkhart, Ind. In September, 1911, he was promoted to designer, with headquarters at Cleveland, O., and served in this capacity until March, 1912, when he was appointed assistant engineer, with the same headquarters. In September, 1915, he became assistant engineer of the New York Central, with headquarters at New York, and in May, 1924, was promoted to assistant superintendent of motive power.

J. W. DODGE, superintendent of fuel conservation of the Illinois Central, with headquarters at Chicago, who retired on August 1, was born on July 29, 1856, at Waterloo, Wis., and entered railway service in April, 1880, as a clerk in the office of the superintendent of the Illinois Central at Centralia, Ill. Three months later he was promoted to chief clerk to the superintendent and in July, 1881, was transferred to Cairo, Ill. In July, 1882, he accompanied the general manager as secretary during an inventory of the Chicago, St. Louis & New Orleans just prior to its transfer under lease to the Illinois Central, and on his return was promoted to assistant agent at Cairo and later to acting agent and commercial agent at the same point. From July, 1887, to April, 1890, he served as chief clerk to the general superintendent at Chicago, when he resigned because of his health. He then spent five years on the Pacific coast, four of them as secretary of the Chamber of Commerce of Seattle, Wash. He returned to railway service in January, 1896, as a clerk in the mechanical department at Chicago, where he remained until April, 1897, when he was transferred to Memphis, Tenn., as chief clerk to the superintendent. In July, 1901, he was transferred to Water Valley, Miss., and in July, 1905, was promoted to supervisor of trains and tracks at Durant, Miss., where he served until October, 1908. He then returned to Memphis as chief clerk to the general superintendent and later was transferred to New Orleans. From July, 1911, to May, 1912, he was division superintendent at Vicksburg, Miss., and was then promoted to inspector of transfers at Chicago. In January, 1924, he was appointed to the newly created position of superintendent of fuel conservation. From 1922 to 1925, Mr. Dodge served as the vice-president of the International Railway Fuel Association and as president of the same organization during 1925-1926.

J. W. Dodge

W. H. FLYNN, whose appointment as general superintendent of motive power of the New York Central, with headquarters in New York, was announced in the October *Railway Mechanical Engineer*, was born on June 24, 1877, at Buffalo, N. Y. He was graduated from the Michigan Agricultural College, and entered railway service in September, 1899, as a draftsman in the offices of the Cleveland, Lorain & Wheeling. From September, 1900, to March, 1902, he held the position of draftsman in the mechanical engineer's office of the Michigan Central. In March, 1902, he was promoted to assistant foreman, and, later, to general foreman of the Jackson locomotive shops, which position he held until September, 1907. From September, 1907, to June 1, 1912, he served as master mechanic at St. Thomas, Ont. On June 1, 1912, he was promoted to superintendent of motive power of the same road, and in April, 1925, was transferred to New York, as superintendent of motive power on the New York Central.

Master Mechanics and Road Foremen

M. U. WARD has been appointed road foreman of engines on the Toledo, Peoria & Western.

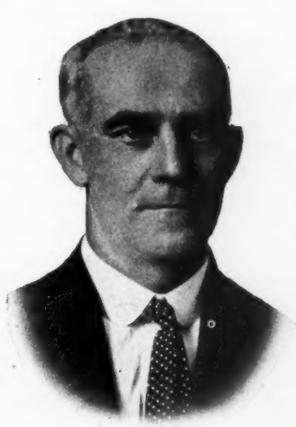
A. HAMBLETON, master mechanic of the Chicago, Rock Island & Pacific at Dalhart, Tex., has been transferred to Trenton, Mo., succeeding J. M. Kerwin.

G. C. JONES, division road foreman of engines of the Atlantic Coast Line at Waycross, Ga., has been appointed general road foreman of engines with headquarters at Jacksonville, Fla.

J. L. Rawlings has been appointed assistant road foreman of engines of the Virginia division of the Seaboard Air Line, with headquarters at Norlina, N. C., succeeding C. B. Ranson.

F. G. TOATES, assistant road foreman of engines of the Southern Pacific at Los Angeles, Cal., has been promoted to road foreman of engines of the San Joaquin division, with headquarters at Bakersfield, Cal.

EDWARD RICHARD DOWDY, whose appointment as master mechanic of the Chesapeake & Ohio, with headquarters at Richmond, Va., was announced in the September issue of the *Railway Mechanical Engineer*, was born on April 18, 1880, in Cumberland County, Va. After attending the Miller Manual Labor School near Crozet, Va., he served his apprenticeship with the Newport News Shipbuilding & Dry Dock Company, at Newport News, Va. He entered the employ of the C. & O. on May 12, 1902, and for thirteen years was a machinist at the Seventeenth street shops at Richmond. He then served successively as assistant foreman and foreman, and for over two years was equipment inspector at Schenectady, N. Y., and at Newport News. He was then promoted to general foreman at Newport News, later being called to the general office and assigned special



E. R. Dowdy

duties. On October 1, 1925, he became assistant master mechanic of the Fulton shops at Richmond.

J. M. Kerwin, master mechanic on the Chicago, Rock Island & Pacific, at Trenton, Mo., has been transferred to the Illinois division and placed in charge of the locomotive and car departments, with headquarters at Silvis, Ill.

J. J. Fitzgerald, acting master mechanic of the Chicago Terminal division of the Chicago, Rock Island & Pacific at Chicago, has been promoted to master mechanic in charge of the locomotive department at the same place.

C. B. Ranson, assistant road foreman of engines of the Seaboard Air Line at Norlina, N. C., has been promoted road foreman of engines, East Carolina division, with headquarters at Andrews, S. C., succeeding C. A. Goodwin, deceased.

R. D. Bulluck, division road foreman of engines of the Atlantic Coast Line at South Rocky Mount, N. C., has been appointed master mechanic of the Richmond, Norfolk and Fayetteville districts, with headquarters at Rocky Mount, N. C., succeeding J. H. Painter.

J. H. Painter, master mechanic of the Atlantic Coast Line at Rocky Mount, N. C., has been transferred to the Wilmington district, with headquarters at Wilmington, N. C. Mr. Painter has been in continuous service on the Atlantic Coast Line for 20 years. In September, 1906, he became locomotive gang foreman; in December, 1906, locomotive erecting shop foreman; in July, 1907, general foreman; in December, 1909, shop superintendent, Emerson shops, and in November, 1923, master mechanic at Rocky Mount.

Car Department

W. S. Bennett, car foreman of the St. Louis-San Francisco at Kansas City, Mo., has been transferred to Birmingham, Ala.

Guy B. Davis, shop inspector on the Union Pacific, has been promoted to general car foreman, with headquarters at Grand Island, Neb.

W. A. Hutton, car foreman of the St. Louis-San Francisco at Neodesha, Kans., has been transferred to Kansas City, Kans., succeeding W. S. Bennett.

Shop and Enginehouse

Louis V. Mallory, gang foreman of the Missouri Pacific at Kansas City, Mo., has been promoted to division foreman, Memphis division, with headquarters at Lexa, Ark.

E. J. Ball, acting superintendent of shops of the New York, New Haven & Hartford, at Van Nest, N. Y., has been appointed superintendent of shops, with the same headquarters.

A. H. Ostberg, mechanical inspector at the West Burlington shops of the Chicago, Burlington & Quincy, has been promoted to the newly created position of assistant superintendent of the Aurora shops, with headquarters at Aurora, Ill.

Purchases and Stores

C. E. Swanson, storekeeper of the Chicago, Burlington & Quincy at Plattsmouth, Neb., has been transferred to Denver, Colo.

W. O. Weber has been appointed division storekeeper of the Northern Pacific, with headquarters at Dilworth, Minn., succeeding A. C. Johnson.

C. A. Nichols, district storekeeper of the Northern Pacific at St. Paul, Minn., has been promoted to traveling storekeeper, with the same headquarters, succeeding H. M. Smith.

H. M. Smith, traveling storekeeper on the Northern Pacific, with headquarters at St. Paul, Minn., has been promoted to assistant general storekeeper, with the same headquarters.

A. C. Johnson, division storekeeper of the Northern Pacific at Dilworth, Minn., has been promoted to district storekeeper, with headquarters at St. Paul, Minn., succeeding C. A. Nichols.

E. H. Grometer, general foreman of stores on the Chicago, Burlington & Quincy, with headquarters at Aurora, Ill., has been appointed storekeeper at Plattsmouth, Neb., succeeding C. E. Swanson.

C. C. Kyle, general storekeeper of the Northern Pacific, with headquarters at St. Paul, Minn., who has been promoted to purchasing agent to succeed R. J. Elliott, promoted to director of purchases, entered railroad service in 1892, as a stenographer on the Northern Pacific at Brainerd, Minn. Later he was promoted to chief clerk at Brainerd and he occupied both positions until 1904, when he was transferred to St. Paul as chief clerk in the mechanical department. In 1916, he was promoted to superintendent of the general office building at St. Paul where he remained until 1921, when he was appointed acting general storekeeper, with the same headquarters. In the next year he was appointed general storekeeper.

C. C. Kyle

T. J. Hegeman, on the staff of the vice-president on the Chicago, Burlington & Quincy, has been appointed superintendent of reclamation and scrap, with headquarters at Eola, Ill.

Robert J. Elliott, purchasing agent of the Northern Pacific, at St. Paul, Minn., who has been promoted to director of purchases, with the same headquarters, was born at Louisville, Ky., and began railway work as a clerk in the accounting department of the Northern Pacific, in March, 1892. A short time later he was transferred to the staff of the general manager, and after serving the company in various capacities he was, in 1905, promoted to general storekeeper, with headquarters at St. Paul. In 1907, he was promoted to assistant purchasing agent, with the same headquarters, where he remained until 1921, when he was again promoted to purchasing agent. He held this position until the recent enlargement of the purchasing organization which he will continue to direct from the newly created position of director of purchases.

R. J. Elliott

Obituary

Ernest L. Akans, master mechanic on the Southern at Atlanta, Ga., died at his home on October 5.

P. J. Meade, master mechanic of the Atlantic Coast Line, with headquarters at Wilmington, N. C., died in that city on September 30, 1926.

C. B. Daily, master mechanic of the Chicago, Rock Island & Pacific, with headquarters at the Forty-seventh street shops, Chicago, died on September 23.

William O. Cook, master mechanic on the Denver & Rio Grande Western, at Denver, Colo., from 1923 to 1925, died at his home in Denver on September 18.

Walter G. Tubby, who resigned as general storekeeper of the Great Northern in 1905, to become chief of the division of materials and supplies of the Isthmian Canal Commission, died on September 22 at Seattle, Wash., from heart trouble.